Devoted to
TEXTILE
CHEMISTRY
BLEACHING
DYEING
PRINTING
FINISHING

FEBRUARY 10, 1947
VOLUME 36, No. 3

AMERICAN DYESTUFF REPORTER

FEB 24
GREENVILLE PUBLIC LIBRARY

For the Buyers' Market

If we can believe the book and our own experience, the buyers' market is sure to be with us — in some industries sooner than others.

When that happens, and the buyer again becomes choosey, it is a grand feeling to know that if any product will stand up in a competitive field yours will — and it will *if* you use the faster-to-light *Solophenyl** colors for Cotton or Rayon.

**Reg. U. S. Patent Office*

GEIGY COMPANY, INC.
89-91 BARCLAY STREET — NEW YORK—NEW YORK
Boston · Providence
Philadelphia · Charlotte
Chicago · Portland, Ore.
Toronto
Geigy
Dyestuff Makers Since 1859
In Great Britain
The Geigy Co., Ltd.
National Buildings
Parsonage, Manchester

OFFICIAL PUBLICATION
of the
PROCEEDINGS
AMERICAN ASSOCIATION
OF TEXTILE CHEMISTS
AND COLORISTS

YES!
YOU CAN MEET
THE DEMAND FOR
IMPROVED
STAIN RESISTANCE
WATER REPELLENCE
WITH

PARAMUL 115

A Cyanamid Textile Finish for

COTTON
RAYON
LINEN
WOOLENS

PARAMUL** 115 Water Repellent is an aqueous solution of wax and aluminum salts that imparts superior water repellency and stain resistance to a wide variety of fabrics—cotton, rayon, linen and wool. It is equally suitable for treating such fabrics for outerwear or equipment purposes. Easy and economical to use. Odorless and harmless to skin or fabric. Stable over a wide range of temperatures, it can be stored safely for long periods of time. In its ability to meet a specific need precisely, PARAMUL 115 is typical of the many Cyanamid products developed for use in the textile industry.

CALL CYANAMID! The services of Cyanamid's technical service staff backed by our extensive textile research facilities are ready to assist you to achieve superior results . . . *economically* . . . in water repellence and stain resistance for your fabrics.

Industrial Chemicals Division

AMERICAN CYANAMID COMPANY

AMERICAN CYANAMID COMPANY PRODUCTS

30 ROCKEFELLER PLAZA • NEW YORK 20, N. Y.

AMONG CYANAMID PRODUCTS FOR THE TEXTILE INDUSTRY ARE... Penetrants, Softeners, Finishes, Sizing Compounds, DECERESOL® Wetting Agents, PARAMUL®®115 Water Repellent, and other Specialties and Heavy Chemicals. For low-cost chemical equivalent of distilled H_2O...FILT-R-STIL® Demineralizing Units.

*Reg. U. S. Pat. Off. **Trade-mark

American Dyestuff Reporter, Vol. 36, No. 3, February 10, 1947. Published every other Monday. Copyright 1947, by Howes Publishing Co., One Madison Ave., New York 10, N. Y. Domestic subscription, $5.00; Canadian, $6.00; Foreign, $6.00. Entered as second-class matter, Nov. 6, 1919, at the New York, N. Y., Post Office, under the act of March 3, 1879.

DYESTUFFS
CIBA
DYESTUFFS • CHEMICALS • INTERMEDIATES
CIBA COMPANY INC.
Greenwich & Morton Sts.
NEW YORK
BOSTON · CHICAGO · MONTREAL · CHARLOTTE
PROVIDENCE · SAN FRANCISCO · PHILADELPHIA
VAT DYES OF THE DOW CHEMICAL COMPANY

Handle 'Em With Minimum Pull Threads

by using

ETERNALURE

D-15*

RESIN FINISH

THIS ONE-TREATMENT FINISH for nylons has many production advantages – not the least of which is the superior snag resistance it provides, which insures handling of hose with minimum pull threads.

Look over the following outstanding results assured by the use of Eternalure D-15 and you'll know why so many leading brands of nylon hose are finished with this material.

Clarified Stitch
Eternalure D-15 tightens and clarifies the stitch on any denier hose, and considerably improves the "eye-appeal."

On 15-20 Denier
This finish is particularly useful in giving these sheer nylons a good body for easy handling after boarding. Valuable also for 30 and 40 denier.

One Treatment
The complete finish is obtained with the one material except when Eternalure DM is added where a full, soft hand is desirable.

No Change in Operations
is involved when you use Eternalure D-15. Hose is finished in the normal manner.

No Deposits on Forms
Resin deposits do not build up on the forms when you use Eternalure D-15.

Ask for a Demonstration!

No Sticking to Forms
Nylons finished with this material do not stick to the forms.

Non-Toxic • Non-Flammable
Eternalure D-15 is completely safe for use from the production viewpoint.

Dermatologically Safe
Eternalure D-15 has been proved by exhaustive dermatological tests to have no primary irritation action and no sensitizing effect on human skin.

*Patented

onyx RESIN FINISHES FOR HOSIERY

Onyx Oil & Chemical Company

JERSEY CITY 2, N. J.

CHICAGO • PROVIDENCE • CHARLOTTE • ATLANTA • LOS ANGELES

In Canada: Onyx Oil & Chemical Co., Ltd. Montreal, Toronto, St. Johns, Que.

For Export: Onyx International Jersey City 2, N. J.

PALATINES for wool

PALATINE FAST DYESTUFFS

...offer the lowest coloring costs for quality results.

...have chrome color fastness (without the addition of chrome) by simple acid dyeing process.

...are fast to light, washing, perspiration, crocking, sea water and wear.

...are level dyeing on mixed wool and carbonized goods without neutralization—with excellent penetration. Most types are dischargeable with Rongalite.

...are particularly suitable for men's wear, dress goods, gabardines, tropical worsteds, cloakings, bathing suits, knitting yarns, carpet yarns and tops.

...on Nylon give maximum fastness to light and washing. The method of application is simple and the results are excellent.

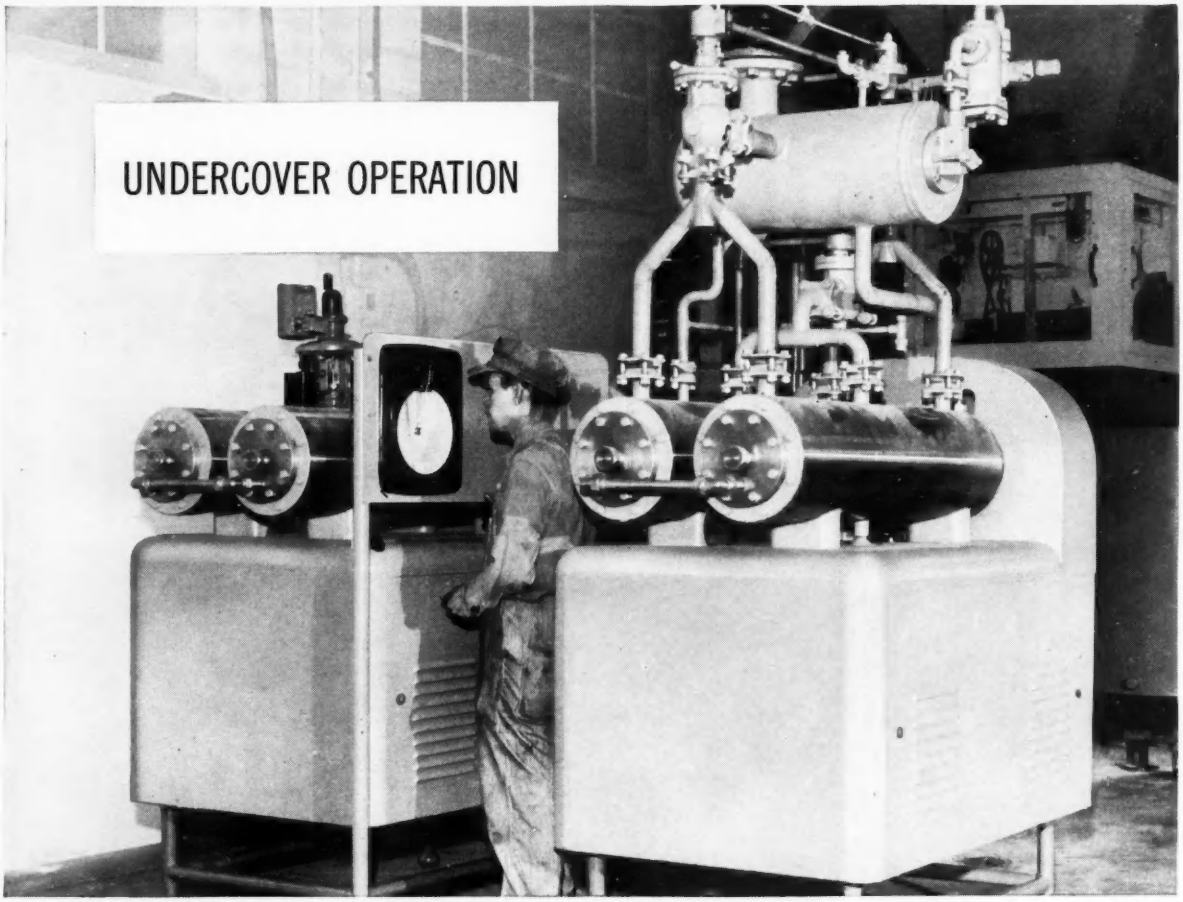
GDC

more production with less manpower

GENERAL DYESTUFF CORPORATION

FOUR THIRTY-FIVE HUDSON STREET · NEW YORK 14, N. Y.

BOSTON · PROVIDENCE · PHILADELPHIA · CHICAGO · CHARLOTTE · SAN FRANCISCO



fights high cost of Starch Paste for textile printers!

NEAT and clean isn't it! Not a drop spilled over. No waste goes on the floor. No safety hazard.

But more important, the undercover VOTATOR equipment cooks and cools starch paste for textile printing gum in half the floor space required by messy open-kettle methods—and with less than half the labor. An exclusive, patented heat transfer mechanism brings temperatures up and down in seconds *as the material flows through* VOTATOR *equipment on a continuous basis.*

And because of precise mechanical control over temperatures and mixing, plus positive exclusion of grit, paste of uniformly fine consistency is achieved with 10 per cent less starch.

In other words VOTATOR equipment reduces starch paste cost by many good, hard dollars. The plant installation shown here will amortize itself in less than a year.

For the recommendations of VOTATOR engineers about an installation to meet your particular starch paste requirements, get in touch with The Girdler Corporation, Votator Division, Louisville 1, Kentucky.

DISTRICT OFFICES: 150 Broadway, New York City 7
2612 Russ Bldg., San Francisco 4 • 617 Johnston Bldg., Charlotte 2, N.C.

Votator
T. M. Reg. U. S. Pat. Off.

CONTINUOUS, CLOSED PROCESSES FOR VISCOUS & LIQUID MATERIALS

New AHCOFLEX *Softeners*

for 2 in 1 Performance

When you want an inexpensive penetrating softener for heavier, coarser cottons such as denims, ducks and coverts, specify Ahcoflex.

Ahcoflex gives 2-in-1 performance in thorough softening action, and re-wetting of fabrics which are to be Sanforized. Ahcoflex has been tested and proved in carefully selected full scale finishing processes. Now, Ahcoflex is available in quantity.

This new softener is easy to use, generally compatible with all ordinary finishing agents, and it will neither discolor fabrics nor cause them to become rancid during storage. Eliminate entirely the nuisance of two products and two operations on fabrics to be Sanforized. Use Ahcoflex for 2-in-1 economy and efficiency.

Write for test sample and further information, or send us a swatch of your coarse cottons for Ahcoflexing here.

ARNOLD, HOFFMAN & CO., INC.

MANUFACTURING CHEMISTS

ESTABLISHED 1815 • PLANTS AT DIGHTON, MASS. AND CHARLOTTE, N. C.

PROVIDENCE, RHODE ISLAND

NEW YORK BOSTON PHILADELPHIA CHARLOTTE

Water-Soluble Waxes

Coupling Agents

Wetting Agents

Lubricants

Leveling Agents

Spot Removing Solvents

Emulsion Chemicals

CALL THE OFFICE NEAREST YOU

Albany 7, N. Y.	50 State Street	Albany 5-7502
Baltimore 2, Md.	231 East North Avenue	SAratoga 0179
Boston 16, Mass.	137 Newbury Street	COMmonwealth 4520
Buffalo 2, N. Y.	424 Main Street	WAshington 9916
Charlotte 2, N. C.	116½ South Church Street	Charlotte 4-4107
Chicago 1, Ill.	230 North Michigan Avenue	RANdolph 8633
Cincinnati 6, Ohio	920 East McMillan Street	AVon 4450
Cleveland 14, Ohio	1517 Superior Avenue	CHerry 5366
Detroit 2, Mich.	3011 West Grand Boulevard	TRinity 1-4265
Indianapolis 4, Ind.	729 North Pennsylvania Street	RIley 3577
Los Angeles 11, Calif.	2305 East 52nd Street	KImball 8253
Newark 2, N. J.	1060 Broad Street	MArket 3-8665
New York 17, N. Y.	30 East 42nd Street	MUrray Hill 2-6800
Philadelphia 22, Pa.	1649 North Broad Street	FRemont 7-6551
Pittsburgh 19, Pa.	311 Ross Street	COurt 2155
San Francisco 4, Calif.	114 Sansome Street	DOuglas 1640
Seattle 4, Wash.	2901 First Avenue South	MAin 6247
St. Louis 8, Mo.	3615 Olive Street	FRanklin 6390

SYNTHETIC ORGANIC CHEMICALS

CARBIDE AND CARBON CHEMICALS CORPORATION

Unit of Union Carbide and Carbon Corporation

UCC

30 East 42nd Street, New York 17, N. Y.

Why you can't buy all the Caustic Soda, Soda Ash, Sodium Bicarbonate and Chlorine you want... and what to expect for 1947 and 1948.

Much has been written about the need for more Caustic Soda, Soda Ash, Sodium Bicarbonate and Liquid Chlorine but, to date, little has been done to explain the reasons for the shortage of these products. In the following Question-Answer columns, Mathieson endeavors to tell American industrialists just why they can't get all they want of these vital chemicals . . . and what the 1947-1948 outlook is for alkali and chlorine production.

Q. *Why are caustic soda, soda ash, sodium bicarbonate and chlorine now in short supply when there was an ample supply before the war?*

A. Expansion of the alkali-chlorine industry during the war *was not permitted* (except to produce an insignificant tonnage) because of the critical shortage of materials that would have been needed for this construction. However, during the same war period, alkali-consuming industries, such as aluminum, rayon, textiles, chemicals and glass food-containers, and chlorine-consuming industries, such as DDT, synthetic detergents and plastics, were allowed to expand their production or construct new facilities. These will continue as growing peace-time consumers.

Q. *Was there less alkali for consumers in 1946 than in 1945?*

A. During 1946 there was less tonnage available than in 1945 due to interruptions in production caused by coal and other strikes. If these interruptions do not recur, there should be some increase in alkali tonnage supply for 1947, but certainly not enough to meet the increased demand.

Q. *How much alkali and chlorine are being exported?*

A. Practically no chlorine. Only a negligible fraction of the pre-war tonnage of caustic soda, soda ash and sodium bicarbonate is now being shipped out of this country.

Q. *Is there any idle capacity in the alkali and chlorine industry?*

A. Only four small government-owned caustic-chlorine plants. Two of these plants have finally been leased to private industry and will be placed in operation in early '47. This additional tonnage is only a "drop in the bucket" when measured in terms of the overall shortage.

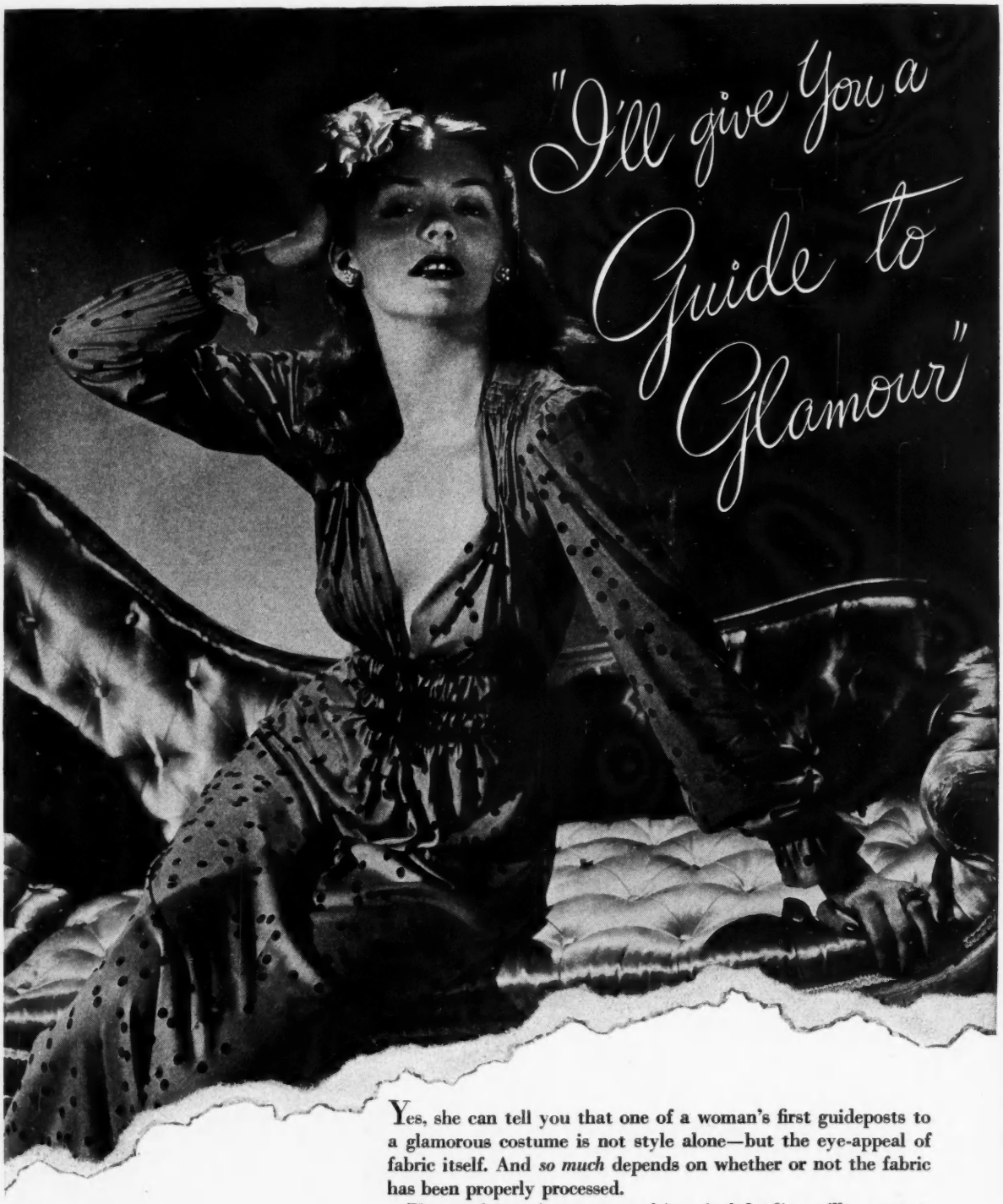
Q. *Are alkali and chlorine producers expanding their facilities?*

A. Yes, several producers, including Mathieson, are expanding facilities for one or more products. Some of this expansion was started immediately following VJ Day. But the special heavy equipment necessary (boilers, kilns and turbines) is as high on the industry shortage list as are alkali and chlorine . . . result: expansion cannot possibly be completed until late '47 or early '48.

THE MATHIESON ALKALI WORKS (INC.)
60 East 42nd Street, New York 17, N. Y.

Mathieson
CHEMICALS

Caustic Soda • Soda Ash • Bicarbonate of Soda • Liquid Chlorine
Chlorine Dioxide • Ammonia, Anhydrous & Aqua • HTH Products
Fused Alkali Products • Synthetic Salt Cake • Dry Ice • Carbonic Gas
Sodium Chlorite Products • Sodium Methylate

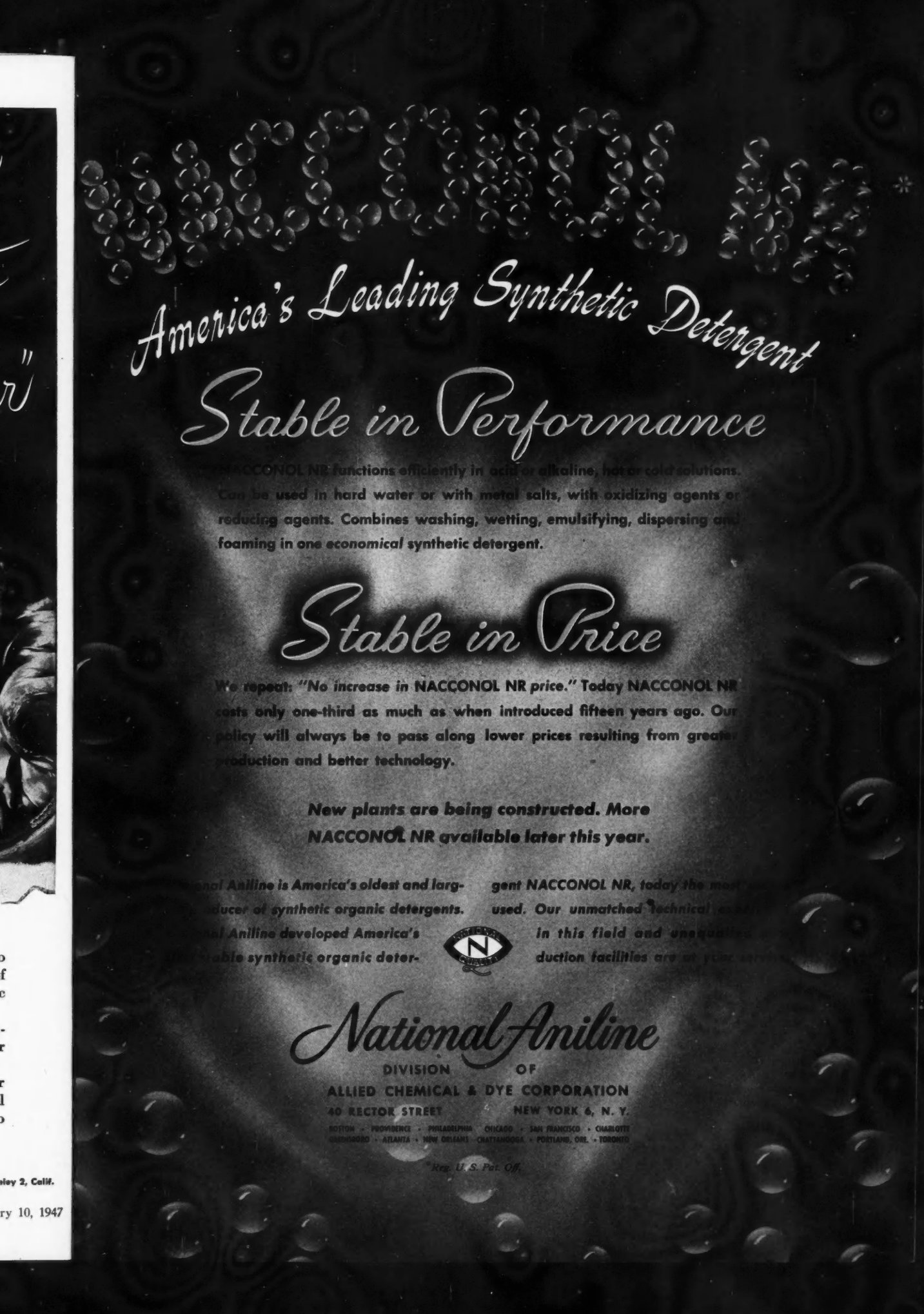


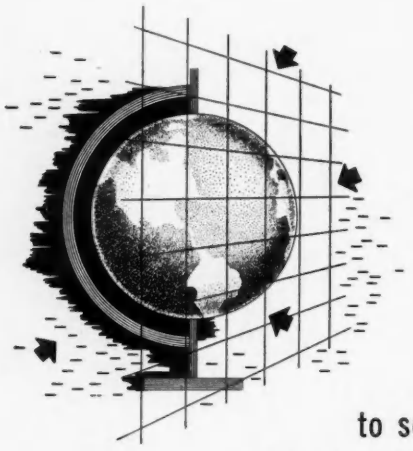
Yes, she can tell you that one of a woman's first guideposts to a glamorous costume is not style alone—but the eye-appeal of fabric itself. And *so much* depends on whether or not the fabric has been properly processed.

That explains why so many of America's leading mills, converters, finishers and dyers have turned to Colgate-Palmolive-Peet for high-quality wetting, fulling, scouring and dispersing agents.

Remember, there is a C.P.P. soap or synthetic detergent for every type of fabric—for every processing problem. Ask your local Colgate-Palmolive-Peet representative for details. Or, write to Industrial Department, Colgate-Palmolive-Peet Company.

Colgate-Palmolive-Peet Co. Jersey City 2, N. J. • Atlanta 2, Ga. • Chicago 11, Ill. • Kansas City 3, Kans. • Berkeley 2, Calif.


NACCONOL NR*
America's Leading Synthetic Detergent
Stable in Performance
NACCONOL NR functions efficiently in acid or alkaline, hot or cold solutions. Can be used in hard water or with metal salts, with oxidizing agents or reducing agents. Combines washing, wetting, emulsifying, dispersing and foaming in one economical synthetic detergent.
Stable in Price
We repeat: "No increase in NACCONOL NR price." Today NACCONOL NR costs only one-third as much as when introduced fifteen years ago. Our policy will always be to pass along lower prices resulting from greater production and better technology.
New plants are being constructed. More NACCONOL NR available later this year.
National Aniline is America's oldest and largest producer of synthetic organic detergents. National Aniline developed America's first workable synthetic organic detergent NACCONOL NR, today the most widely used. Our unmatched technical experience in this field and unequalled production facilities are at your service.
National Aniline
DIVISION OF
ALLIED CHEMICAL & DYE CORPORATION
40 RECTOR STREET NEW YORK 6, N. Y.
BOSTON · PROVIDENCE · PHILADELPHIA · CHICAGO · SAN FRANCISCO · CHARLOTTE
GREENSBORO · ATLANTA · NEW ORLEANS · CHATTANOOGA · PORTLAND, ORE. · TORONTO
*Reg. U. S. Pat. Off.



Spin the Globe...

There's a FALLEK Representative Everywhere!

Here is your opportunity to secure World Wide Distribution for American Dyestuffs ...

READ THESE FIGURES!

92% of the world's total exports in Coal-Tar Colors, Dyes and Stains were supplied by Europe to the rest of the world.*

4.6% of the world's total exports in Coal-Tar Colors, Dyes, and Stains were supplied by the United States to the rest of the world.*

With foreign production at a minimum level, now is the opportune time for American Suppliers to secure a solid foothold in the most lucrative overseas markets . . . and here is how FALLEK can help you:

FALLEK ... eliminates costly credit risks. *You receive your check when your goods are ready for shipment* . . . as simple as a domestic transaction, but larger profits.

FALLEK ... creates an acceptance for your products throughout world markets that assures continuous business.

FALLEK ... gains you the proper entree with leading firms of known responsibility.

FALLEK ... gives you intelligent, daily sales coverage through representatives located in every world market.

FALLEK ... means permanence, through long established outlets in Europe, Latin America, and the Orient.

FALLEK ... saves you the detail handling and numerous expenses of operating an export department.

FALLEK ... brings you men of wide experience, men highly skilled in the problems of world distribution . . . plus skilled technicians in every foreign office fully equipped to render all the technical information necessary to users of American Dyestuffs.

American dyestuffs for textiles, leather, paper, etc., are in urgent demand throughout the world. You can realize a sizeable share of this business by making FALLEK your foreign selling agents. THIS is the time to safeguard profits against the hazards of "buyer's market" or a falling off in domestic demand, by developing a substantial export volume. FALLEK can do this for you.

**U. S. Tariff Commission Report No. 19 last pre-war figures*

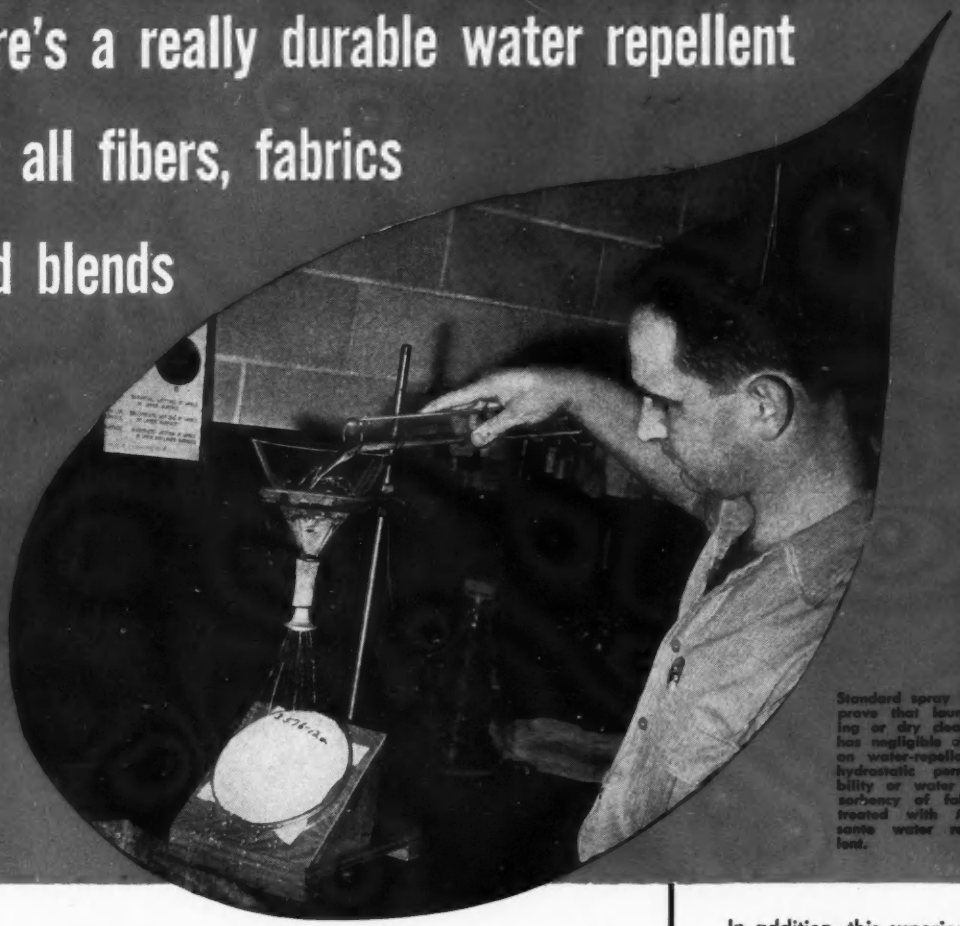
WRITE, WIRE OR PHONE FOR FURTHER INFORMATION.

FALLEK PRODUCTS COMPANY, INC.

149 BROADWAY • NEW YORK 6, N. Y.

SPECIALISTS IN ORGANIC CHEMICALS

here's a really durable water repellent for all fibers, fabrics and blends



Standard spray tests prove that laundering or dry cleaning has negligible effect on water-repellency, hydrostatic permeability or water absorbency of fabrics treated with Monsanto water repellent.

This new Monsanto water repellent makes exciting news with *two* important features:

FIRST

Durable water repellency, fast to repeated laundering or dry cleaning.

SECOND

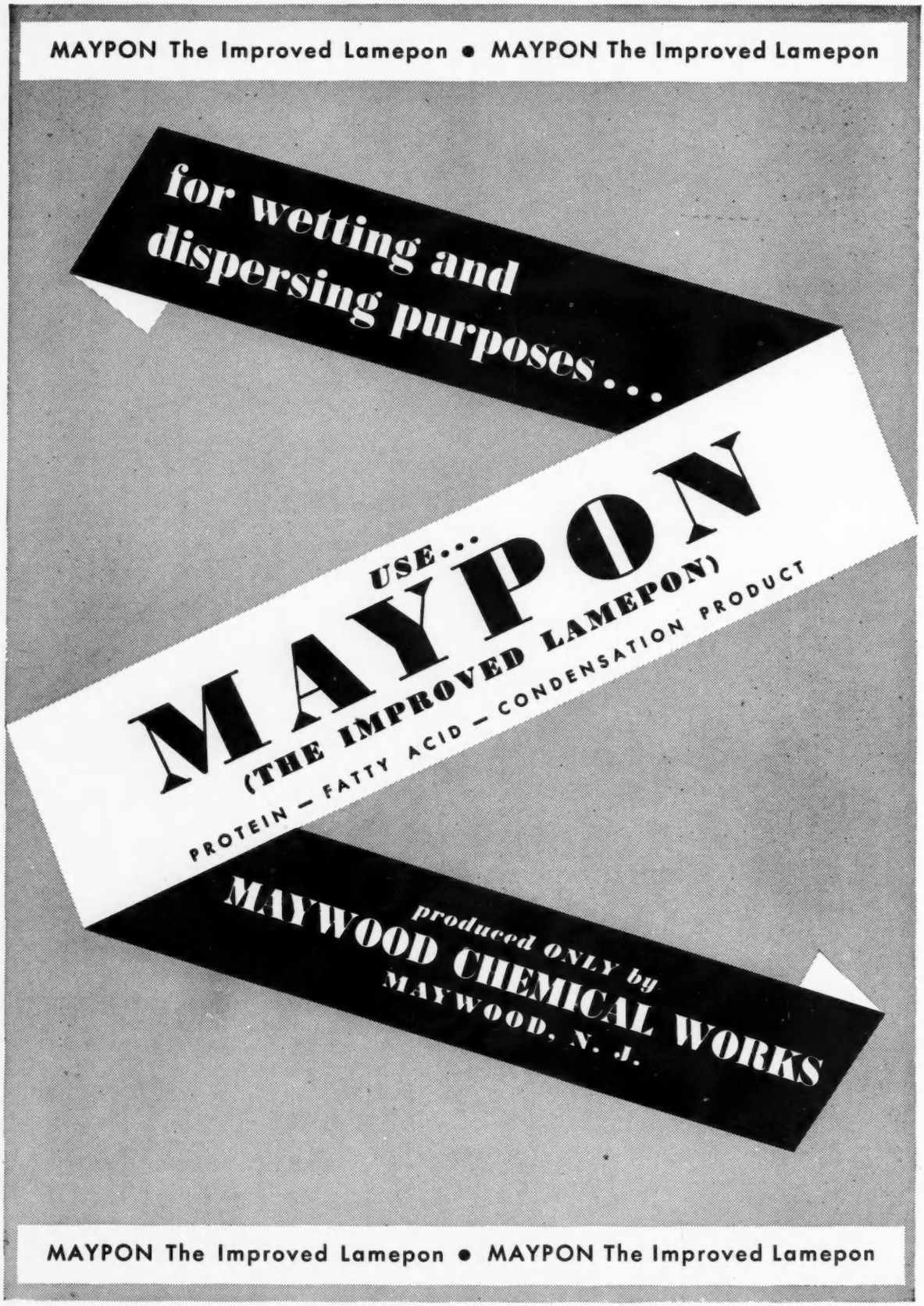
Outstanding effectiveness on *all* textile fibers including wool, aralac, nylon, acetate, cotton, rayon and mixtures of these fibers.

In addition, this superior Monsanto water repellent gives you these definite advantages:

1. Increased textile strength
2. Freedom from objectionable odors
3. Ease of application
4. Imparts soft dry finish
5. Outstanding spot resistance

For complete technical information, samples and counsel on adapting Monsanto water repellent to your fabrics, write, wire, phone: MONSANTO CHEMICAL COMPANY, Textile Chemicals Department, 140 Federal Street, Boston 10, Massachusetts.

MONSANTO
CHEMICALS AND PLASTICS
SERVING INDUSTRY... WHICH SERVES MANKIND


MAYPON The Improved Lamepon • MAYPON The Improved Lamepon
for wetting and dispersing purposes . . .
USE . . .
MAYPON
(THE IMPROVED LAMEPON)
PROTEIN — FATTY ACID — CONDENSATION PRODUCT
produced ONLY by
MAYWOOD CHEMICAL WORKS
MAYWOOD, N. J.
MAYPON The Improved Lamepon • MAYPON The Improved Lamepon

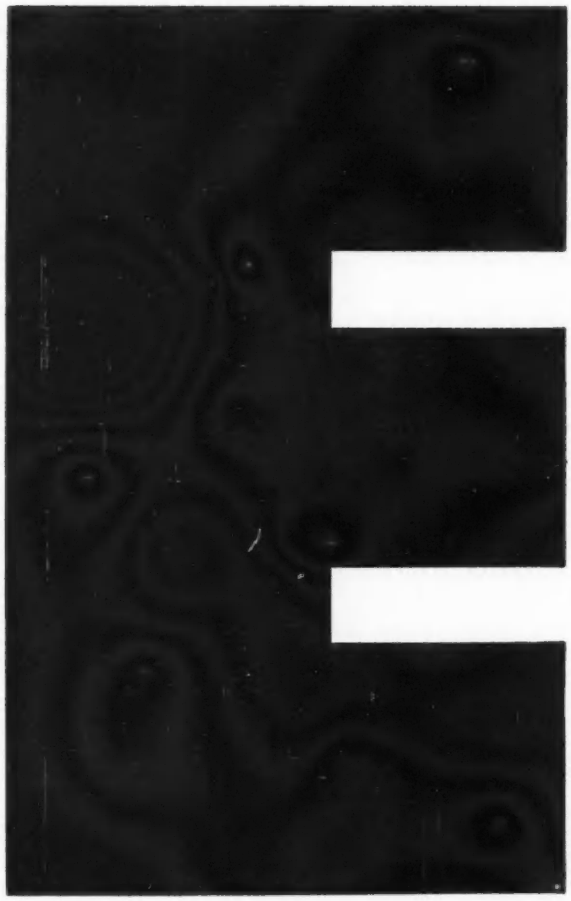
EASTONE RED B

For Plain or Dischargeable Dyeing of Acetate Rayon and Nylon

EASTONE RED B, because it dyes acetate rayon an unusually fast red with a bluish cast, is unique among red acetate dyestuffs. Light concentrations of the dye produce soft, neutral shades of pink. It dyes nylon a bright rubine shade.

Eastone Red B dyes and levels exceptionally well over temperatures ranging from as low as 140°F to the boil. It is especially recommended for low temperature dyeings and has proved to be a valuable color for both jig and box work wherever rapid penetration and good build-up characteristics at low temperatures are desired. General commercial fastness of Eastone Red B is good—particularly fastness to light and washing, gas fading, crocking, and sublimation when steamed under pressure.

Eastone Red B is one of a wide variety of Eastman Acetate Dyestuffs especially developed for acetate rayon. For information on these dyestuffs, write to TENNESSEE EASTMAN CORPORATION (Subsidiary of Eastman Kodak Company), KINGSPORT, TENNESSEE.



Eastman

ACETATE DYESTUFFS

for your cooperation

We want to take "time out" to thank our loyal friends for their cooperation during the year 1946. Strikes in the chemical industries and raw material shortages reduced our normal supply of Calgon*—But you understood.

A new year is ahead of us—we cannot predict that we will supply your full requirements but we pledge our unstinted efforts, to meet your needs and to serve you during the coming year.

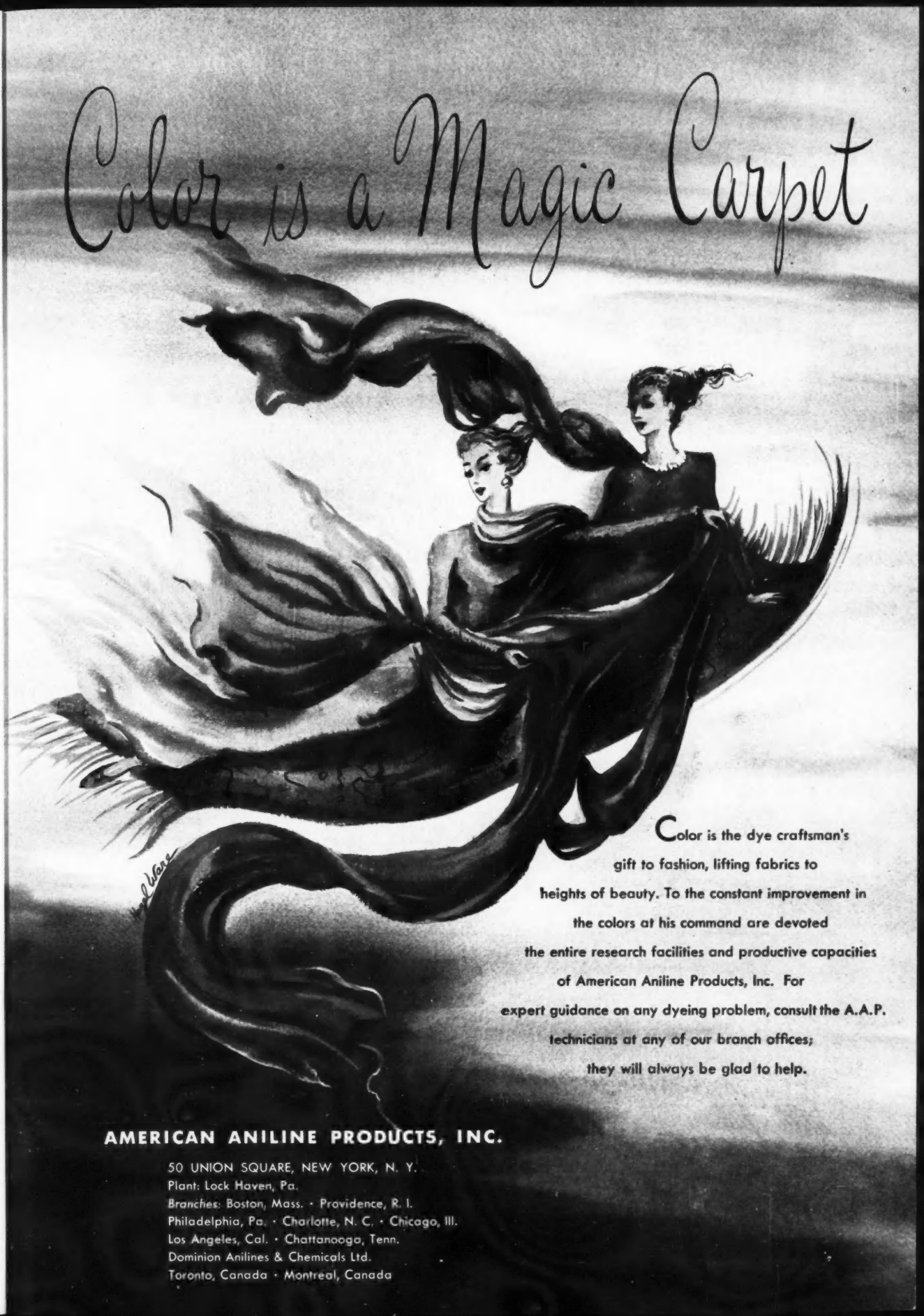
**Trade-mark Reg. U.S. Pat. Off.*

HAGAN
HALL
BUROMIN
CALGON

calgon, inc.

A SUBSIDIARY OF
HAGAN CORPORATION

HAGAN BUILDING
PITTSBURGH 30, PA.


Color is a Magic Carpet
Color is the dye craftsman's gift to fashion, lifting fabrics to heights of beauty. To the constant improvement in the colors at his command are devoted the entire research facilities and productive capacities of American Aniline Products, Inc. For expert guidance on any dyeing problem, consult the A.A.P. technicians at any of our branch offices; they will always be glad to help.
AMERICAN ANILINE PRODUCTS, INC.
50 UNION SQUARE, NEW YORK, N. Y.
Plant: Lock Haven, Pa.
Branches: Boston, Mass. · Providence, R. I.
Philadelphia, Pa. · Charlotte, N. C. · Chicago, Ill.
Los Angeles, Cal. · Chattanooga, Tenn.
Dominion Anilines & Chemicals Ltd.
Toronto, Canada · Montreal, Canada

No Trade Names to Bewilder You...
Just the Name "Hooker" to Remember

You can find the names of all Hooker Products in a good chemical dictionary. That is, all except the most recent products of our Research Laboratories. A better place to find them is in the Hooker Products List, which contains nearly one hundred Hooker Products, their main chemical and physical characteristics, suggested uses and shipping information. But whether you want dye intermediates, mordants, catalysts, solvents or other chemicals you use, you don't have to try to remember a number of synthetic words—just think of Hooker.

A few of the Hooker Chemicals popular in the textile field are listed below. All are of the uniform high quality that insures smooth, uninterrupted operations. For further information on any of these or the other Hooker Textile Chemicals, drop us a line on your business letterhead.

PRODUCT *Chemical Formula; Molecular Weight*	HOOKER SPECIFICATIONS	SUGGESTED USES
Acetyl Chloride CH_3COCl; 78.5	Color . . . . . Clear, colorless to pale yellow Distillation Range . . . . . 95% of distillate, within 5° C including 51°C	Manufacture of chemical intermediates and dyes.
Antimony Trichloride, Anhydrous $SbCl_3$; 228.1	Antimony Trichloride . . . . . 99% Min. Iron and Arsenic . . . . . 1% Max. Lead 0%	Catalyst in organic synthesis; mordant in textile printing. Moisture and fireproofing textiles.
Benzal Chloride $C_6H_5CHCl_2$; 161.0	Clear, yellow liquid. Boiling range . . . . . 200 to 235° C Specific Gravity 15.5°/15.5°C . . . . . 1.279 ± .005	Dyestuff intermediate
Chlor Anisidine $NH_2C_6H_3ClOCH_3$; 157.5	Gray crystalline solid. Melting Point . . . . . 79°C Min. Diazo Test . . . . . Relatively clear.	Dye intermediate.
Metanitrobenzoyl Chloride $NO_2C_6H_4COCl$; 185.5	Yellow to brown liquid, partially crystallized Last crystal point . . . . . 28 to 31°C	Manufacture of dyes.
Monochlorbenzene C_6H_5Cl; 112.5	Clear, colorless liquid. Distillation Range . . . . . 131.3 to 132.3°C	Dyestuff intermediate, preparation of sulfur black, brown dyes.
Orthodichlorbenzene $C_6H_4Cl_2$; 147	Clear, colorless liquid. Freezing Point . . . . . -10 to -22°C Boiling Range 6° including . . . . . 179°C	Manufacture of pyrocatechin, dye intermediate, other synthetic organic chemicals. Degreasing wool.
Sodium Sulfhydrate NaSH; 56.1	NaSH . 70 to 72% NaCl . . . . . 1% Max. Fe . . 5ppm Max. Na_2SO, $NaHCO_3$ . . . . . 1% Max. Na_2S . . . 1 to 2% Cu, Ni, Cr, Mn, Pb . . 1 ppm Max. Water of crystallization . . . . . 28 to 26%	Desulfurizing rayon; calico printing; in sulfur dye baths.
Sodium Sulfide Na_2S; 78.1	Na_2S . . . . . 60 to 62% Fe . . . . . 8 ppm. Max. NaCl . . . . . 1.5% Max. Other Na Salts . . . . . 2.0% Max. Cu, Ni, Cr, Mn, Pb . . . . . 1 ppm. Max. Water of crystallization . . . . . 36.5 to 34.5%	Desulfurizing rayon; calico printing; in sulfur dye baths.

HOOKER ELECTROCHEMICAL COMPANY

2139

2 FORTY-SEVENTH ST., NIAGARA FALLS, N. Y.
New York, N.Y. Wilmington, Calif. Tacoma, Wash.

HOOKER CHEMICALS

Caustic Soda **Chlorine** **Muriatic Acid** **Paradichlorbenzene**

CUT HEAT EXCHANGER REPLACEMENT COSTS WITH

"KARBATE"

BRAND

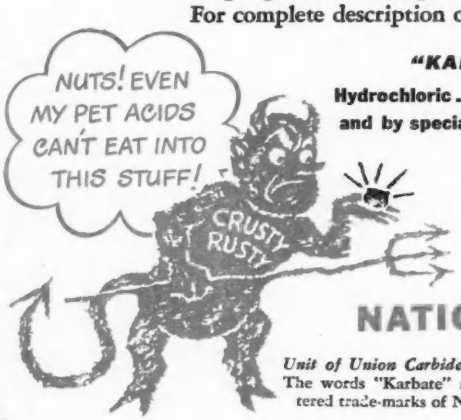
HEAT EXCHANGERS – THEY LAST *Indefinitely*

● "Karbate" Heat Exchangers will help you end the expense and delay of constantly replacing corroded heat exchangers!

"Karbate" Heat Exchangers are chemically inert. They are free from corrosion scale formation. Thus, they will stay on the job indefinitely—saving substantial replacement costs over the years.

"Karbate" Heat Exchangers have other stand-out features: A remarkably high rate of heat transfer • Extreme heat shock resistance • Light weight • Strong, sturdy – able to take rough treatment • Can be made in a variety of sizes and types from the simple plate to the large tube-bundle types.

For complete description of "Karbate" Heat Exchangers, write Dept. AD.



"KARBATE" MATERIAL UNAFFECTED BY

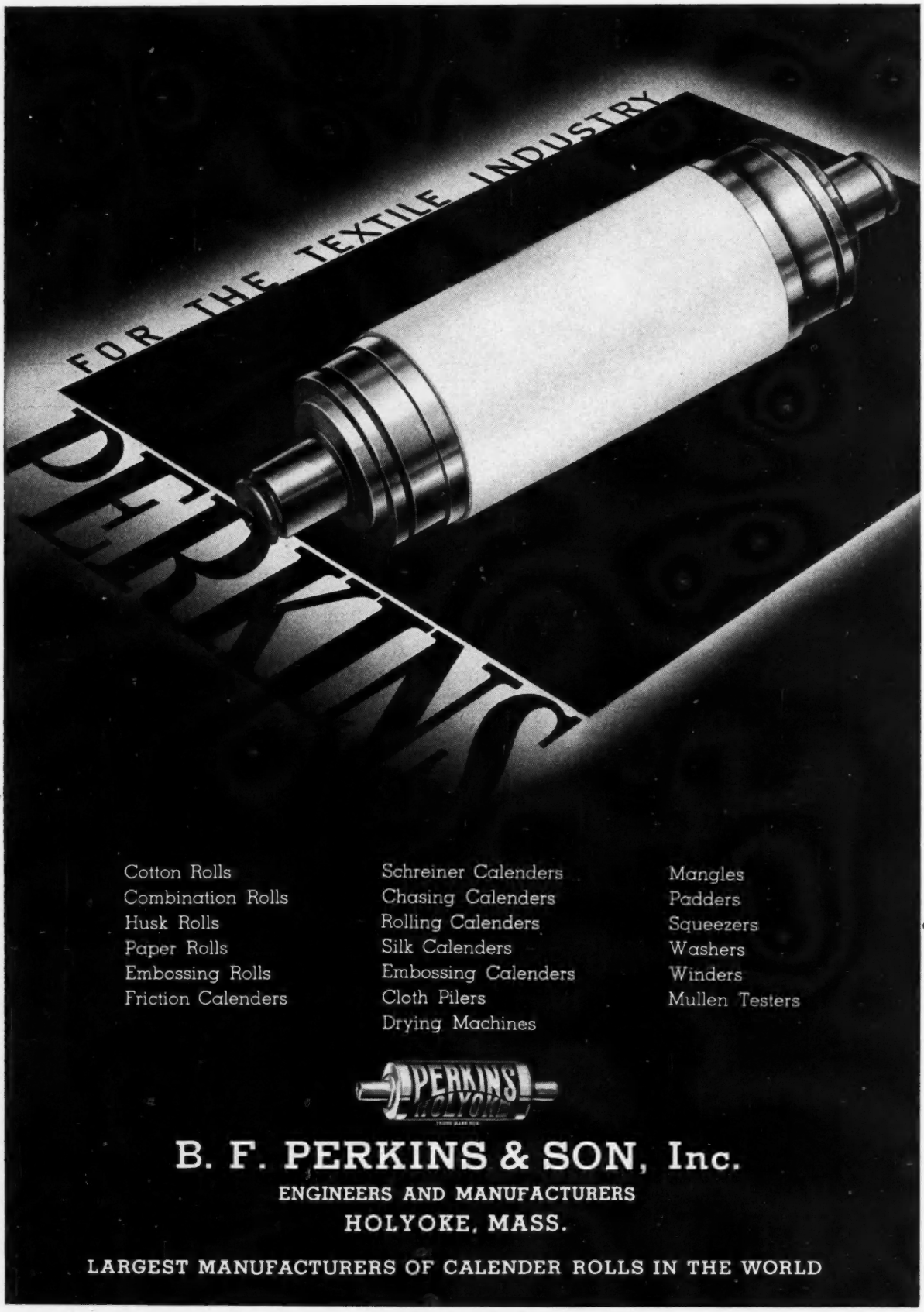
Hydrochloric . . . sulphuric . . . lactic . . . acetic . . . hydrofluoric acids . . . and by special caustic vapors . . . and other corrosive liquids and gases.

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide and Carbon Corporation
The words "Karbate" and "National" are registered trade-marks of National Carbon Co., Inc.

UCC

30 East 42nd Street, New York 17, N. Y.
Division Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco



Cotton Rolls
Combination Rolls
Husk Rolls
Paper Rolls
Embossing Rolls
Friction Calenders

Schreiner Calenders
Chasing Calenders
Rolling Calenders
Silk Calenders
Embossing Calenders
Cloth Pilers
Drying Machines

Mangles
Padders
Squeezers
Washers
Winders
Mullen Testers

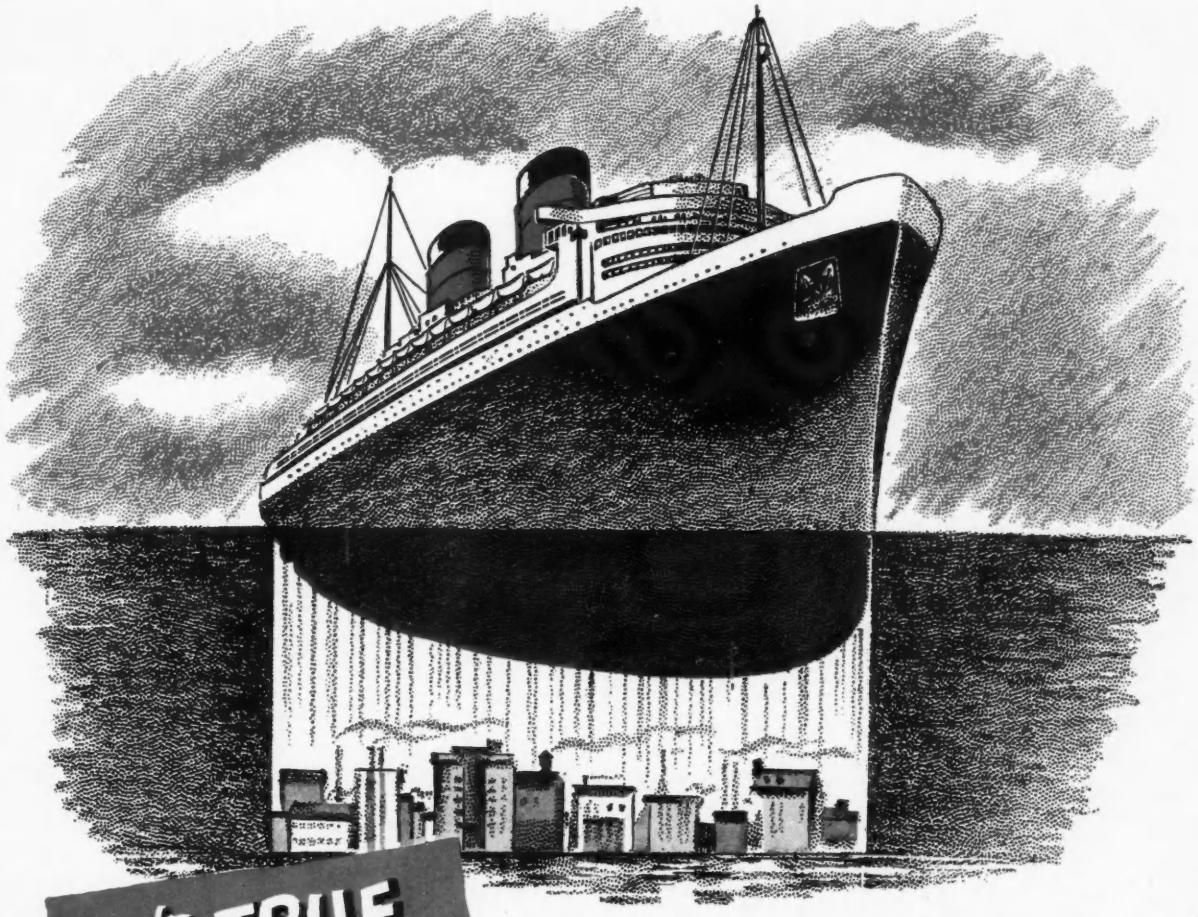
PERKINS HOLYOKE

B. F. PERKINS & SON, Inc.

ENGINEERS AND MANUFACTURERS

HOLYOKE, MASS.

LARGEST MANUFACTURERS OF CALENDER ROLLS IN THE WORLD



IT'S TRUE...

THE LINER QUEEN ELIZABETH DISPLACES ABOUT THE SAME AMOUNT OF WATER THAT THE CITY OF BALTIMORE, MD. USES IN A DAY!

STANDARD OIL COMPANY OF NEW JERSEY
Elizabeth, N. J.—Baltimore, Md.—Richmond, Va.—Charleston, W. Va.
Charlotte, N. C.—Columbia, S. C.—New Orleans, La.—Little Rock, Ark.
Memphis, Tenn.

STANDARD OIL COMPANY OF PENNSYLVANIA
Philadelphia, Pa.

COLONIAL BEACON OIL COMPANY
Boston, Mass.—New York, N. Y.

IT'S TRUE OF ESSO SOLVENTS

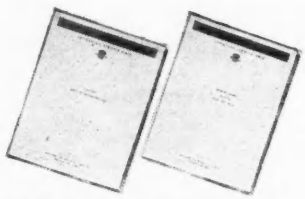
THE TOTAL GALLONAGE OF **ESSO SOLVENTS** SOLD LAST YEAR WOULD FLOAT ALMOST 5 SHIPS THE SIZE OF THE QUEEN ELIZABETH!

Careful manufacturing control is the important factor in the production of Esso Petroleum Solvents. In this way we maintain the correct combination of physical attributes in any specific solvent. Hundreds of industries depend on the constant suitability and uniformity in solvents that the Esso trademark assures. See your Esso Representative next time you order.

An old friend
of the rayon industry returns
NOPCO* 1111
premier soaking oil and warp size softener

Back "in harness" for the first time since the beginning of the war, Nopco 1111 returns to assure rayon throwsters and weavers the same quality and uniformity which made it the standard in pre-war days.

*REG. U. S. PAT. OFF.



WRITE for data bulletins "Important Points Regarding Rayon Warp Sizing." "Nopco 1111 – Soaking Oil for Rayon Crepe Yarns."

NATIONAL OIL PRODUCTS COMPANY, HARRISON, N. J.

Branches: Boston • Chicago • Cedartown, Ga. • Richmond, Calif.

NOPCO

EVOLVED THROUGH RESEARCH

SULFRAMIN

A SYNTHETIC ORGANIC DETERGENT; EFFECTIVE EVEN IN DILUTIONS OF *1 to 10,000*

OF SPECIAL INTEREST TO THE TEXTILE INDUSTRY...

SULFRAMIN DT and SULFRAMIN LW (Powder) Powerful synthetic detergents and foaming agents unsurpassed wherever hard water presents a problem. LW has a higher lauric content, and consequently is preferred when used in water colder than 50° C. Textile processors and manufacturers of dyeing assistants, use either type, depending upon the temperature of the solution.

SULFRAMIN DH (Paste) A concentrated, slightly alkaline detergent offering great money value as an all around boil-off compound. It is adaptable to the manufacture of various scouring, boiling-off and dyeing assistants; and is usable under any water conditions.

SULFRAMIN DR A neutral compound of high wetting and scouring qualities, having the appearance of a clear, sulphonated oil. It is immediately soluble in hot or cold water, and is therefore an ideal dyeing assistant. It can be employed advantageously as a straight product or in conjunction with various sulphonated oils.

SULFRAMIN DHL A clear, leveling agent having the appearance of a sulphonated oil; and suitable for solving your most vexing dyeing problems. It has powerful leveling and penetrating qualities, and assures complete satisfaction in the processing of rayon and acetate fabrics.

SULFRAMIN DT (Paste) A strictly neutral, synthetic detergent, with good wetting qualities and complete resistance to hard water. Manufacturers of dyeing assistants, and textile processors, use it principally in scouring and dyeing preparations. Being neutral, DT is particularly useful in alkaline solutions.

SULFRAMIN N This is a non-foaming wetting agent, having the appearance of a heavy paste. Although of radically different chemical structure, Sulframin N shares many of the advantages inherent in many of the other Sulframin products. Its strongest feature is its complete immunity to the effects of inorganic acids and alkalies. Consequently, it is preferred in the processing of wool, such as in carbonizing, in dyeing, etc. Not only is Sulframin N an outstanding leveling agent; it can also be safely employed with any amount of alkali.

ULTRA Chemical WORKS

ULTRA CHEMICAL WORKS, Inc.

• PATERSON, N. J. • *IN CANADA . . . Delta Chemical Company, Brantford, Ontario*

• CHICAGO, ILL. • *IN MEXICO . . . Icon, S. A., Mexico, D. F.*

Valuable additions to our line of . . .

Pharmasols

Brown 2G produces a bright yellow Brown of excellent fastness to washing at a low cost.

Brown R produces a warm Brown of general all-around fastness.

Seal Brown yields a deep Brown at low cost and is of good all-around fastness.

THE THREE NEW BROWNS PRODUCE DESIRABLE TAN SHADES WHEN PRINTED IN REDUCED STRENGTH

THESE NEW BROWNS, especially Seal Brown and Brown R, are easy to apply and show a very pronounced improvement in their

FASTNESS TO LIGHT

against our former Browns

CARBIC COLOR AND CHEMICAL CO., INC.

451-453 Washington Street, New York City

BRANCHES:
PHILADELPHIA
PROVIDENCE HAMILTON, ONT.
CHARLOTTE, N. C.

IMPORTERS OF THE MANUFACTURES OF
DURAND & HUGUENIN S. A.
BASLE, SWITZERLAND

EXCLUSIVE DISTRIBUTORS OF
PHARMASOLS
PHARMOLS
PHARMACINES

Representative: Los Angeles (Hathaway Allied Products)

AMERICAN DYESTUFF REPORTER

LOUIS A. OLNEY, D.Sc.
Directing Editor

NORMAN A. JOHNSON, B.T.C
Managing Editor

MYRON D. REESER
Advertising Manager

GRACE B. BURTON
Production Manager

M. H. MORGAN
Circulation Manager

Official Publication of the Proceedings of the American Association of Textile Chemists and Colorists

Published every other Monday by
HOWES PUBLISHING COMPANY, INC.
One Madison Avenue, New York 10, N. Y.

A. P. HOWES
President

C. R. HOWES
Vice President

H. F. CRAWFORD
Treasurer

M. D. REESER
Secretary

C. ESSENBREIS
Asst. Secretary

Also Publishers of
KNIT GOODS WEEKLY
TEXTILE COLORIST
AND CONVERTER

FEBRUARY 10, 1947

VOLUME 36 NUMBER 3

Contents

Contents of previous issues can be found by consulting the Industrial Arts Index at your library

- **Departments**

Trade Notes—New Products..... 71

- **Proceedings of the American Association of Textile Chemists and Colorists**

Studies on Wool Dyeing: Crocking.....P45
Henry E. Millson, Willard H. Watkins and George L. Royer

Intersectional Contest:

Some Aspects of the Saponification of Acetate Rayon P64

South Central Section

Meeting, Northern New England Section.....P70

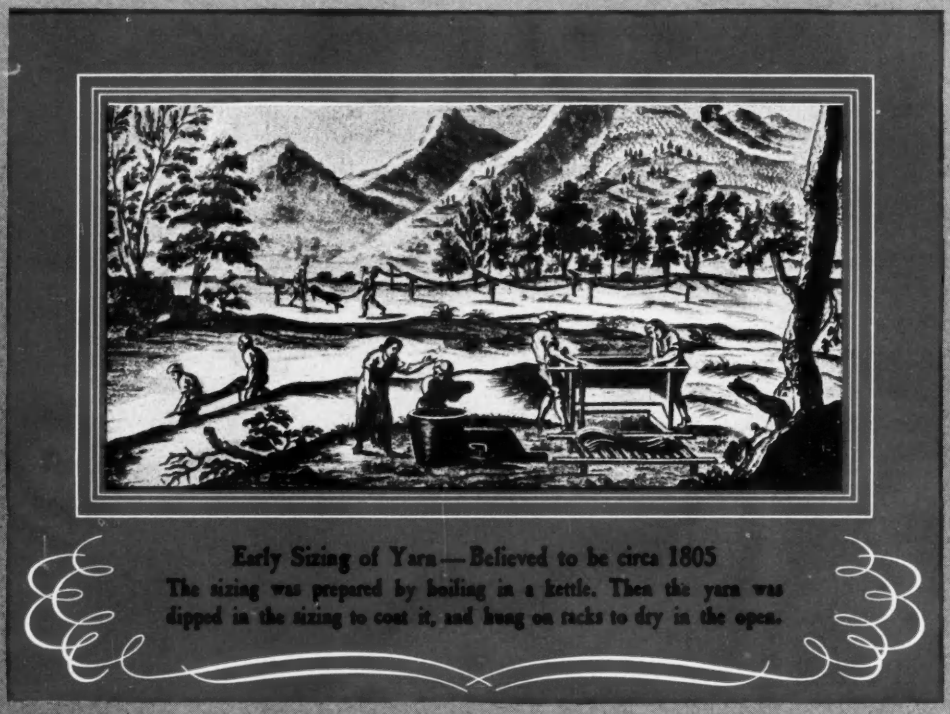
Meeting, Philadelphia Section P70

Meeting, North Carolina Student Chapter.....P70

Calendar of Coming Events P70

Employment Register P70

Copyright, 1947, Howes Publishing Co., Inc.



Early Sizing of Yarn—Believed to be circa 1805
The sizing was prepared by boiling in a kettle. Then the yarn was dipped in the sizing to coat it, and hung on racks to dry in the open.

Why De-Size?

Sizing is added to the warp threads to strengthen and protect them during the weaving operation. Once it has served its purpose, the sizing must be rapidly and effectively removed so that it will neither delay dyeing, bleaching or finishing, nor impair the quality of the work.

Rapidase gives complete satisfaction in
de-sizing cottons, rayons and mixed goods.

RAPIDASE

WALLERSTEIN COMPANY, INC. 180 Madison Ave., New York 16, N. Y.

Proceedings of the
American Association of Textile Chemists and Colorists
FEBRUARY 10, 1947

Studies on Wool Dyeing: Crocking*

HENRY E. MILLSON, WILLARD H. WATKINS and GEORGE L. ROYER

Calco Chemical Division, American Cyanamid Company, Bound Brook, N. J.

Synopsis

IN a previous study, the "critical dyeing point" was defined as that period during the dyeing operation, when there was a sudden and sharp increase in color value, on the material being dyed.

In this paper, the "critical crocking-point" is defined as that period in the dyeing operation during which the material being dyed showed the maximum crocking or rubbing off, after which the intensity of the crock decreased. It has been observed that there is a definite correlation between the "critical dyeing point" and the critical crocking point." Just before the critical dyeing point is reached, a large portion of dye is concentrated on the outer parts of the fibers. This concentration of dye does not give maximum color value, but does give the maximum intensity of the crock because the dye at this stage is only loosely attached to the fibers. During the next dyeing period there is a rapid penetration of the dye into the fibers resulting in a sharp and sudden increase in color value and simultaneously there is an equally sharp and sudden decrease in the intensity of the crock. A large number of acid, milling, Calcofast, chrome, direct and basic dyes have been studied. Some of these observations have been recorded by photomicrographs of the cross sections, and longitudinal views of the dyed materials, and a few of these are shown in the color plate in the paper.

It has been found that the fastness to crocking of a dyed material is more dependent upon the proper methods of scouring, dyeing, and finishing than upon the inherent nature of the dye itself. For instance, it has been observed that most dyes, when applied by the proper procedure, give a shade having excellent resistance to crocking, whereas an apparently minor change in the dyeing process often results in a shade which shows poor resistance to crocking.

Calcocid Milling Red BC was chosen for most of the detailed study of the method of dyeing, as it affects crocking, because it gave the most marked variation in the color intensity of the crock. Using this color it has been observed that incomplete scouring, the presence of dye solvents, hard water, drying, shearing, chlorination, Glauber's salt, temperature, pH, and dye concentration have a definite effect on the intensity of the crock.

* Presented at a number of sectional meetings of the AATCC.

Introduction

The mechanical transfer of color from a dyed material to another material with which it comes in contact is called crocking or rubbing. Crocking becomes most evident when a darkly dyed fabric rubs against a white or lightly dyed fabric, and the white or lightly dyed fabric becomes discolored. This discolored area is called the "crock." The difficulty of producing dyed materials which do not exhibit excessive crocking has long been recognized. In the field of cotton coloring, many articles have been written on crocking, dealing particularly with naphthols and vat colors. However, in the field of wool dyeing, little information bearing directly on this subject has been found. *(1,2,3,4,5)* Therefore, the problem of crocking seemed to be sufficiently important to warrant a detailed study.

The importance of using the proper method of application for a dye as it affects color value and fastness properties, such as crocking, washing, and light, has been discussed to some extent in a previous paper of this series *(6)*. The influence of time and temperature on the penetration of dyes has also been discussed *(7)* and it was found that one or more critical points was reached when dye was absorbed from a dye bath. The critical point of a dyeing has been defined as that period during the course of the dyeing procedure when a sudden increase in color development and change from ring dyeing to complete penetration takes place within a narrow range of time and temperature.. During the preparation of this paper, it was found that a critical point of crocking occurred as was shown by comparison of the crocks of the samples removed at different stages of the dyeing operation.

For those dyes which gave a critical crock point, the depth of crock increased up to a maximum with an increase in temperature and time in the dye bath after which there was a sharp decrease in depth of the crock. The period during the dyeing at which the material being dyed showed the maximum depth of crock, has been defined as the "critical crock-point."

There was a correlation between the critical point of dyeing and the critical point of crocking. Both of these critical points vary from dye to dye and can be changed by the dyeing procedures and pre-treatments. All of the dyes used for study in this paper were commercial types.

General Techniques

During the preparation of a previous paper (7) on time-temperature studies, microscopical examination of samples removed at different temperatures showed that there was a gradual accumulation of dye on the outer parts of the fibers, during the early stages of the dyeing process. This dye gradually diffused into the fibers to form "rings" and then to completely dye the fibers. For example, cross sections of dyeings of Calcocid Milling Red 3R Conc., removed at 190° F. and at the boil, showed that the dye was present as heavy "rings" at 190° F., but 10 minutes later when the dyeing had reached the boil, the dye had penetrated nearly to the center of the fibers. Crock tests made on samples removed at different times during the course of the dyeing showed that the color intensity of the crock bore a relationship to the amount of dye deposited on the outer parts of the fibers and its subsequent penetration into the fibers. These preliminary observations were developed further and used as a basis for the procedures employed in studying the variables in dyeing processes, which influence crocking.

After the investigation of a large number of Acid and Milling colors, Calcocid Milling Red BC was chosen for special study because it exhibited the most marked variation in the color intensity of the crock, during the course of dyeing.

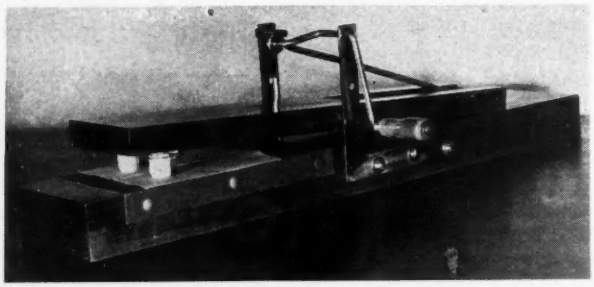


Fig. 1. Two-fingered Crockmeter.

In the general procedure used in making the dyeings on a 5-gram sample of scoured wool flannel, the dye bath contained 2 per cent Calcocid Milling Red BC, 3 per cent Acetic Acid, 56 per cent, and 10 per cent Calcined Glauber's Salt. The dye bath-wool ratio was 60-1. A master bath containing the proper amounts of the above materials was prepared and then subdivided into the number of dye baths required for each series. In this way, each dye bath had exactly the same amount of dye, acid, calcined Glauber's salt, and wool.

The dyeings were started at 100° F. and after 5 minutes at this temperature, one dyeing was removed and rinsed thoroughly. The temperature of all the remaining dyeings was then raised to 110° F., run 5 minutes at this temperature and a second dyeing was removed and rinsed thoroughly. Dyeings were removed after running 5 minutes at the following temperatures: 100° F., 110° F., 120° F., 130° F., 140° F., 150° F., 170° F., 190° F., 200° F., 212° F. Others were removed after boiling for 10, 20, 30, 45, 60, and 90 minute intervals. After rinsing all dyeings were placed on frames and air dried.

Crock tests were made with an AATCC Crockmeter *(8)* as modified by Thomas Scanlon of our laboratories. This instrument, shown in Figure 1, used a 2-finger arrangement which permits wet and dry tests to be run simultaneously. This has decreased the variation generally encountered in crocking tests. Figure 2, which was originally photographed in color, shows sample of the flannel dyed with Calcocid Milling Red BC by the standard procedure described above, together with the wet and dry crocks which were obtained. Color plate, Figure 1, shows a close-up view of the crocks obtained from the samples removed at 190° which was the critical point, at 212° F., which was just after the critical point, and after boiling 1½ hours. It is apparent from the wet and dry crocks, that a maximum of color intensity was reached at a temperature of 190° F. Color plate Figures 5, 9, and 13 show cross sections of the dyeings from which these crocks were obtained. Color plate Figures 6, 10, and 14 show longitudinal views by regular transmitted light of representative fibers, removed from 190°-212° F. and 1½ hours boiled dyeings. Microscopical examination of the surface of the fibers from the 190° F. dyeings by dark field technique, clearly showed that the dye was located on the outer parts. The cross sections also showed that at 190° F. the dye was deposited mostly on the outside of the fibers and that with an increase of 10° F., in temperature and an additional time of 5 minutes, the dye had started to penetrate into the fibers. At 212° F. the dye had ceased to be concentrated on the outside of the fibers and definite penetration was shown. The longitudinal views by regular transmitted light also confirmed this in that at 190° F. considerable amounts

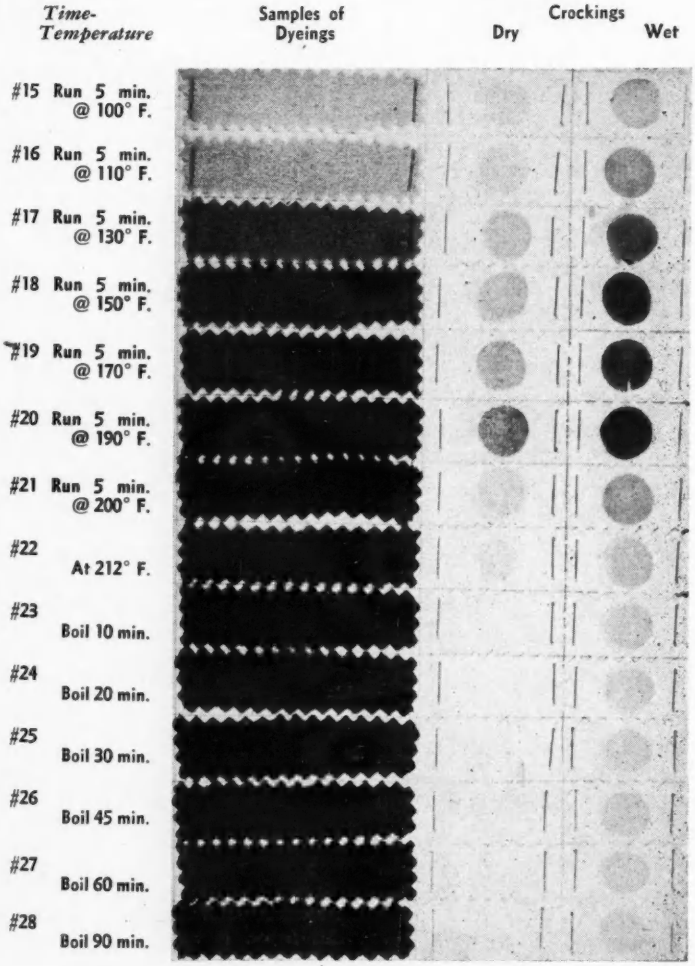

Time-Temperature
Samples of Dyeings
Crockings
Dry
Wet
#15 Run 5 min. @ 100° F.
#16 Run 5 min. @ 110° F.
#17 Run 5 min. @ 130° F.
#18 Run 5 min. @ 150° F.
#19 Run 5 min. @ 170° F.
#20 Run 5 min. @ 190° F.
#21 Run 5 min. @ 200° F.
#22 At 212° F.
#23 Boil 10 min.
#24 Boil 20 min.
#25 Boil 30 min.
#26 Boil 45 min.
#27 Boil 60 min.
#28 Boil 90 min.

Fig. 2. 2% Calcocid Milling Red BC Conc. dyed by standard procedure with 10% Glauber's salt and 3% acetic acid (56%).

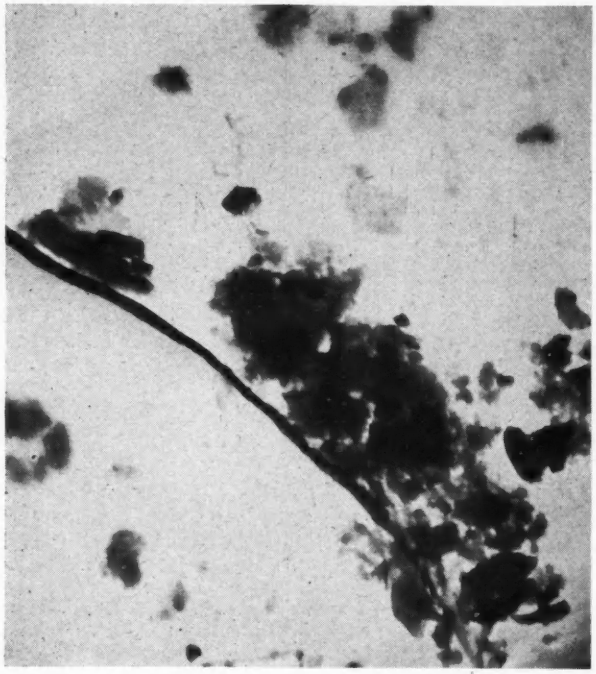


Fig. 3. Electron micrograph of surface of wool fiber removed at 190° F.

of dye could be seen on the surface as specks or small deposits of solid dye. As the boiling was continued, the dye became less evident, because it diffused into the fibers.

The wet crock obtained from the 190° F. sample is shown in color plate Figure 3, at about 5X. It can be seen that there are concentrations of color on many of the threads of the 80 square cotton cloth used for the crock tests. When this was examined at a higher magnification of about 15X, it was evident that the dye was concentrated on the higher threads of the cotton cloth. At a magnification of 150X, particles of dye were seen quite clearly on several fibers taken from the cotton cloth. It had been thought previously that some of the color of the crock might be attributed to minute portions of the dyed fibers which rubbed off during the test and imbedded in the cotton crock cloth. Occasionally there were a few loose fibers on the surfaces of the cotton cloth, which were easily removed by brushing, but practically no evidence of parts of fibers or scales was noticed in our microscopical examinations of the crocks.

Color plate Figure 2 shows a picture of the dry crocks obtained from the same 190° F. dyeing, as used in the preceding paragraph. The shade of the dry crock was much bluer and less dye appeared to be deposited upon the crock cloth. Most of the dye was deposited upon the higher parts of the thread and therefore the white unstained threads were more evident than in the wet crock.

Experiments showed that crocks obtained as above were composed mainly of dye which was not in solution or had not penetrated into the fiber at the time the fabric was removed from the dye bath. Rinsing in water did not remove or dissolve this deposit and the drying operation did not cause it to penetrate or change its position. It was shown that this deposit consisted mainly of dye by using dye solvents such as Carbitol, Cellosolve and urea. When crock tests were made by wetting the cotton cloth with the dye solvent, the ensuing crock on the cotton was entirely different in shade and character. Color plate Figure 4 taken at a magnification of 5X, shows the crock obtained with a crock cloth which had been wet with ethyl Cellosolve. This can be contrasted with Color plate Figures 2 and 3, which show the dry and water wet crocks photographed at the same magnification. It is evident that the deposit on the cloth moistened with Ethyl Cellosolve is much more uniform and finely dispersed than that of the water-wet and dry crocks.

Further evidence that the material which was removed by crocking was dye and not some extraneous material was shown by crocking a time-temperature series of dyeings, made with 2 per cent Calcomine Fluorescent Violet 2G. The crock, though colorless and not discernible in visible light, fluoresced the same violet blue shade in ultra violet as the

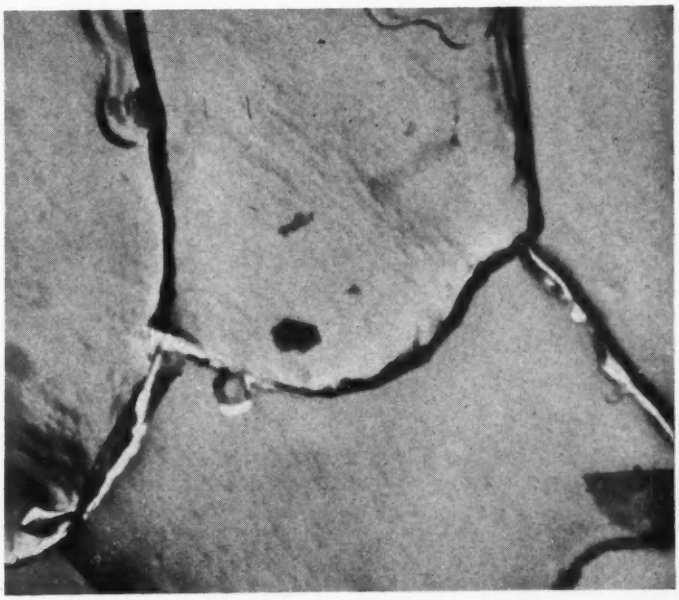


Fig. 4. Electron micrograph of surface of wool fiber removed after boiling 1-1½ hours.

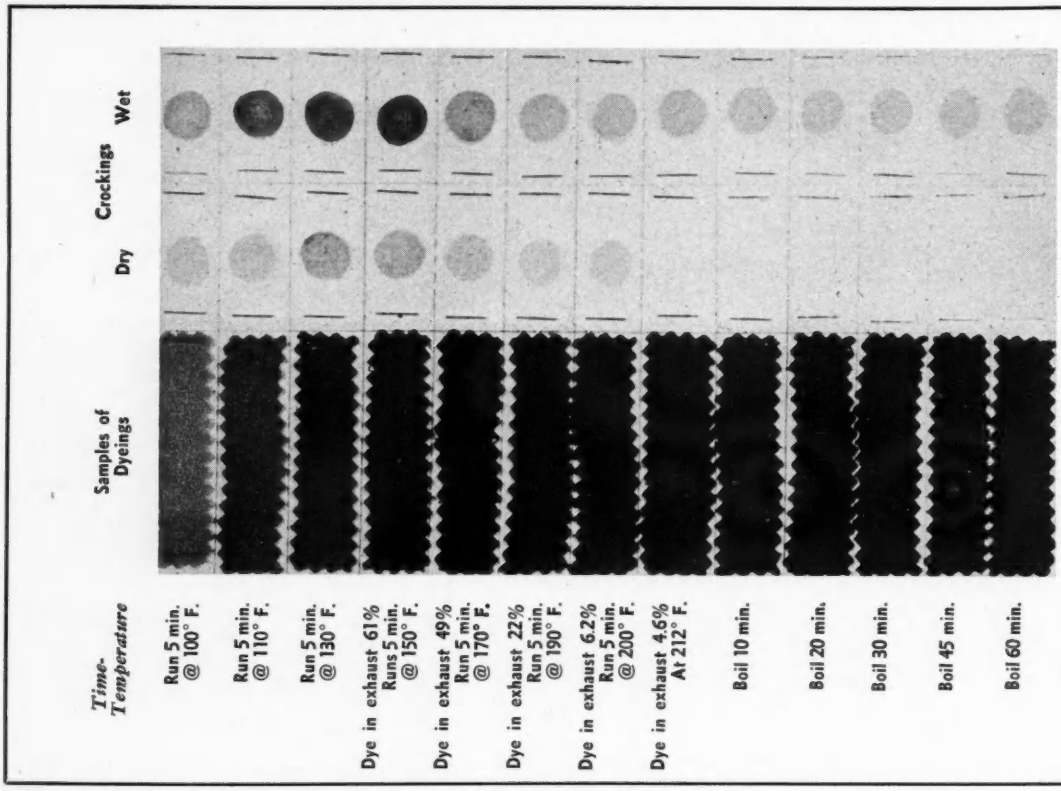

Time-Temperature
Samples of Dyeings
Crockings
Dry
Wet
Run 5 min. @ 100° F.
Run 5 min. @ 110° F.
Run 5 min. @ 130° F.
Dye in exhaust 61% Runs 5 min. @ 150° F.
Dye in exhaust 49% Run 5 min. @ 170° F.
Dye in exhaust 22% Run 5 min. @ 190° F.
Dye in exhaust 6.2% Run 5 min. @ 200° F.
Dye in exhaust 4.6% At 212° F.
Boil 10 min.
Boil 20 min.
Boil 30 min.
Boil 45 min.
Boil 60 min.

Fig. 6. 2% Calcoid Milling Red BC Conc. dyed by standard procedure with 100% Glauber's salt and 3% acetic acid (56%).

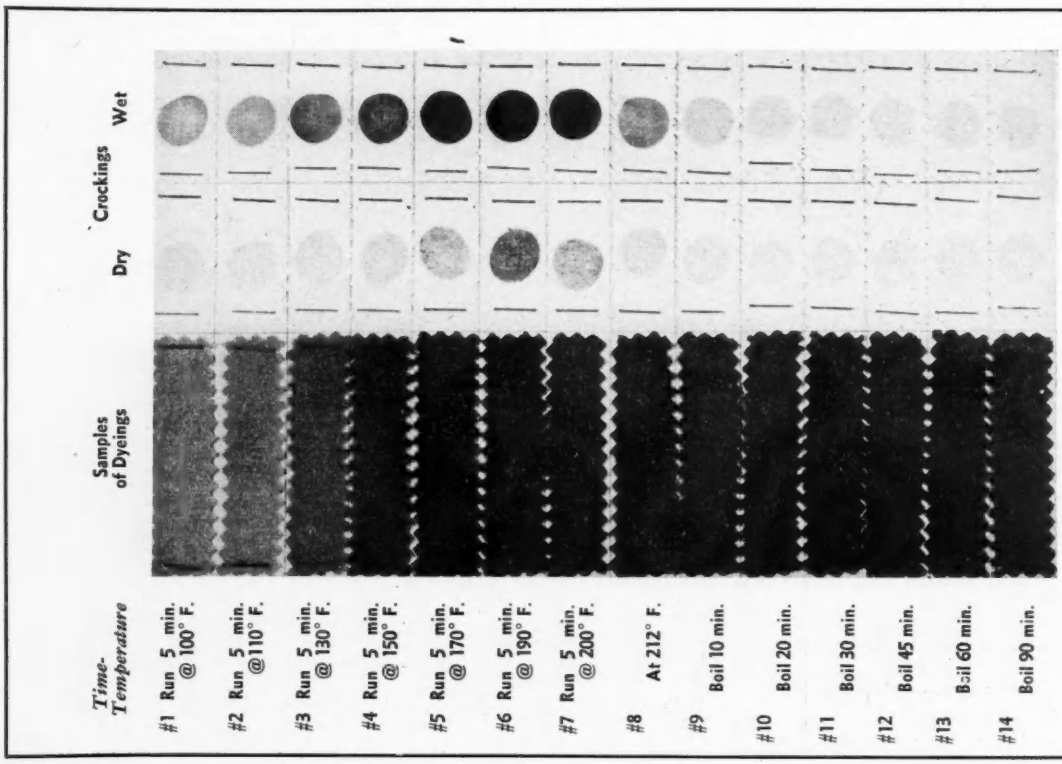

Time-Temperature
Samples of Dyeings
Crockings
Dry
Wet
#1 Run 5 min. @ 100° F.
#2 Run 5 min. @110° F.
#3 Run 5 min. @ 130° F.
#4 Run 5 min. @ 150° F.
#5 Run 5 min. @ 170° F.
#6 Run 5 min. @ 190° F.
#7 Run 5 min. @ 200° F.
#8 At 212° F.
#9 Boil 10 min.
#10 Boil 20 min.
#11 Boil 30 min.
#12 Boil 45 min.
#13 Boil 60 min.
#14 Boil 90 min.

Fig. 5. 2% Calcoid Milling Red BC Conc. dyed by standard procedure with no Glauber's salt and 3% acetic acid (56%).

dyed wool, thus adding to the proof that the dye which caused fluorescence in the wool was the same as that which rubbed off when the crock tests were made.

Electron micrographs made by the polystyrenesilica replica technique of the surface of wool fibers dyed at 190° F. and 1½ hours at the boil, showed some interesting facts in relation to the deposition of dye. Particles of dye were shown to be deposited on the surface of the wool fibers and were concentrated in the areas where the scales joined. Figure 3 is an electron micrograph of the replica of the 190° F. dyeing and shows deposits of the solid dye. Figure 4 is an electron micrograph of the replica of the fiber after boiling 1½ hours, which shows the presence of a few random particles of dye on the surface of the fiber. Apparently the particles of the dye which were deposited on the outside of the fibers during the early stages of the dyeing operation redissolved with time and an increase in temperature, finally penetrating into the fibers. However, some crocking was obtained in practically all cases, because some of the dye that did not redissolve, remained on the surface of the fibers throughout the entire dyeing operation. It appeared that the amount of insoluble dye particles varied with the individual dye and with the method of application.

In the case of dyed fabrics removed during the early stages of dyeing an examination of the area from which color was rubbed during the crocking showed a greater depth of color than the surrounding area. The dry crocked area was changed from a brown red to a clear bright bluish red. This change in shade can be ascribed to a change in the distribution of the dye on the surface of the fibers. The dye as deposited from the dye bath was finely precipitated over the surface and at the interstices of the scale. It is thought that the rubbing smeared the dye, thus securing a better coverage of the undyed reflecting wool surface.

Influence of Method of Application

The method used for the application of dyes is important if dyeings with good resistance to crocking are to be obtained. Although many dyeing methods have been established for years, no known study has been made of the effect of such factors as the quantity of Glauber's salt, the presence of dye solvents, the rate of temperature increase, the temperature of dying, the dye concentration and the pH of the dye bath on the resistance to crocking. As it is desirable to know how each of these does affect the crocking, they have been studied during this investigation.

Effect of Glauber's Salt

In wool dyeing, Glauber's salt is used to aid in the exhaustion and levelling of most acid colors. Time-temperature studies were made with Calcocid Milling Red BC according to the general procedure described previously, with various quantities of calcined Glauber's salt added to the bath. The concentrations used were 0 per cent, 10 per cent, 20 per cent, 30 per cent, 40 per cent, 50 per cent, 100 per cent, 150 per cent and 200 per cent on the weight of the wool. Figures 5, 2, and 6 show the dyeings made in the presence of 0 per cent, 10 per cent, and 100 per cent Glauber's salt respectively removed at different temperatures together with the wet and dry crocks obtained from these dyeings. Spectrophotometric reflectance values of the dyeings and of the wet crocks of these same dyeings are shown in Figures 7, 8 and 9. It is evident from this data that the heaviest crock was generally obtained at approximately the temperature which has been described previously as the critical dyeing point (7). Cross-sectional examination of samples removed at this stage of the dyeing operation showed that the color had been concentrated on the outer parts of the fibers by rapid exhaustion of the dye bath and that penetration into the fibers had started to take place. After the critical point was reached and passed, the color intensity of the crock decreased very rapidly and the color strength of the dyeing increased markedly, as is evidenced by the decrease in reflectance of the dyeings and the increase in reflectance of the resulting crock. These data indicated that the critical point for the dyeing made without Glauber's salt was between 190° and 200° F. When 10 per cent Glauber's salt was added to the dye bath, the critical point was lowered. This was shown by the fact that the most intense crock was obtained between 170°-190° F. As the quantity of Glauber's salt was increased up to 50 per cent, the critical crock point was reached at progressively lower temperatures, so that the maximum depth of crock with 50 per cent, occurred between 150° F. and 170° F. Increasing the percentage of Glauber's salt above 50 per cent showed little, if any, change in the temperature of the critical crock point and the intensity of the crock. These results are in line with the theory that the Glauber's salt reduces the solubility of the dyestuff and causes it to exhaust onto the fibers at lower temperatures during the initial stages of the dyeing operation.

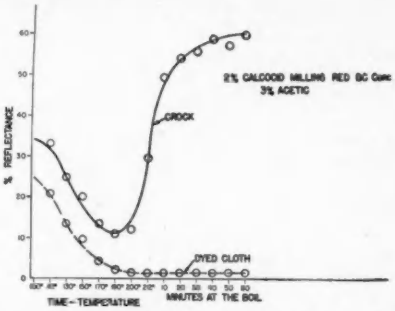


Fig. 7. Plot of Time-Temperature vs. % Reflectance.

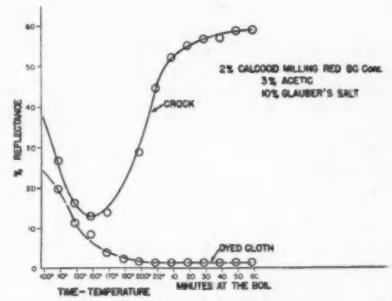


Fig. 8. Plot of Time-Temperature vs. % Reflectance.

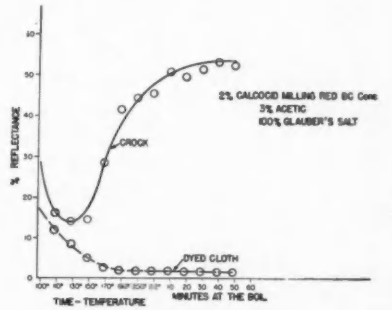


Fig. 9. Plot of Time-Temperature vs. % Reflectance.

Effect of Acid

The effect of acid on the crocking of a Chrome Brown was reported in an earlier paper *(6)* of this series. Microscopical examinations of the cross-sections showed that the completed dyeings of Chrome Brown made with sulfuric acid had color precipitated in and around the individual fibers, with a resulting low color value. A similar dyeing which was made with acetic acid showed excellent penetration, no precipitation of dye and excellent color value. It was found that the dye which had been precipitated by the sulfuric acid could be removed by redissolving it with ammonia and then exhausting it slowly

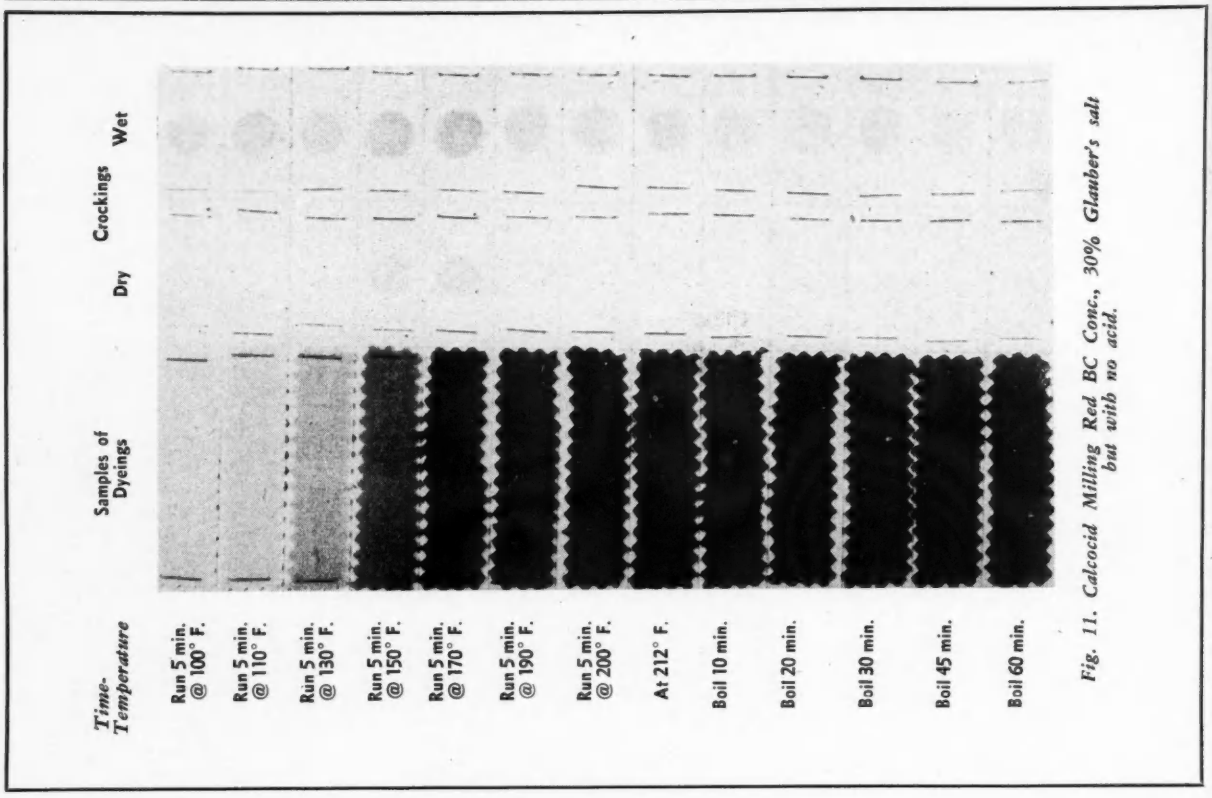


Fig. 11. Calcocid Milling Red BC Conc., 30% Glauber's salt but with no acid.

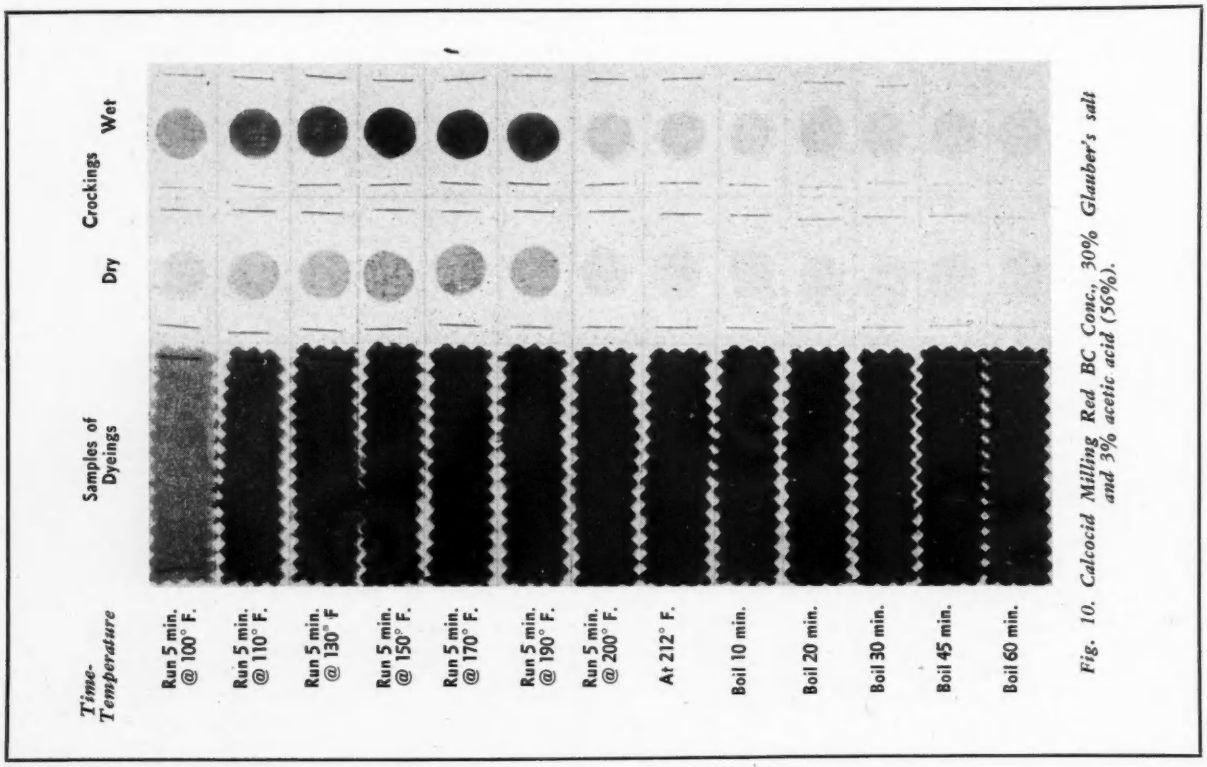


Fig. 10. Calcocid Milling Red BC Conc., 30% Glauber's salt and 3% acetic acid (56%).

with acetic acid to give the excellent color value of the original dyeings made with acetic acid. When Chrome Brown 4RC was dyed on wool using acetic acid and controlling the rate of exhaustion so that all of the dye penetrated the fiber, a dyeing fast to crocking was obtained. When this dyed material was then entered into a fresh boiling bath, containing only 3 per cent of sulfuric acid and Glauber's salt and boiled for one hour, it lost about 65 per cent of its original color value and crocked badly. The dye had been drawn out of the fibers and precipitated on the outer parts of the fibers where it was readily removed by crocking. When an alkaline chemical such as ammonia was added the precipitated dye was redissolved and taken back into the dye bath where it could be exhausted slowly to produce a well-penetrated dyeing.

Experiments have shown that this same phenomenon occurs with other dyestuffs when the pH is too low for the type of dye used. Strong acids have a tendency to precipitate the dye and deposit it on the outside of the fibers in an insoluble form, causing very marked crockings. Many of the colors which act in this manner are known to be sensitive to acid and therefore level very poorly or not at all in strong acid solutions. Many chrome and most milling colors are in this class and must be handled carefully with regard to acid additions, if materials free from cracking are to be obtained.

A series of dyeings of Calcocid Milling Red BC Conc. was made by the same procedure as used in the Glauber's salt series. Thirty per cent Glauber's salt was used in contrast to the normal 10 per cent, but no acetic acid was added. The dyeings and crock tests are shown in Figure 11 and should be compared to those shown in Figure 10, which were made in the presence of 3 per cent acetic acid, 56 per cent. The reflectance values for the dyeings and the crock tests are shown in Figures 12 and 13. They indicate clearly that at the lower temperatures, a much greater crock resulted when acid was used. The maximum intensity for the crock in the case of the acid dyeing was observed at 190°-200° F., while for the dyeing without acid it occurred at 170°-190° F. Thus, differences were noted with some dyes at lower temperatures with small quantities of acetic acid. The differences were not evident after longer periods at the boil, when, as in this case, the dye which was exhausted on the outside of the fibers as solid dye redissolved and penetrated by diffusion into the fibers.

Effect of Temperature

In the discussion under general techniques in the first part of this paper, the effect of temperature upon crocking was

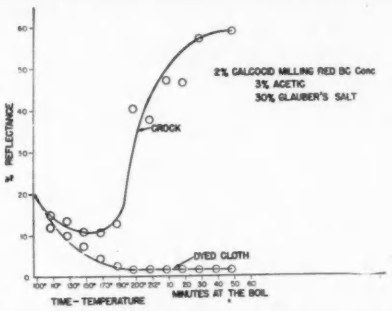


Fig. 12. Plot of Time-Temperature vs. % Reflectance.

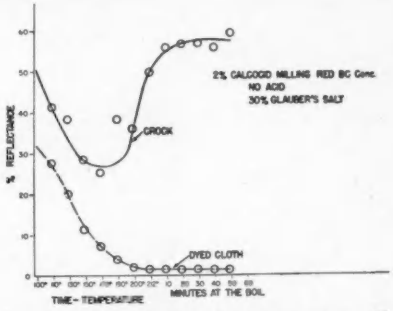


Fig. 13. Plot of Time-Temperature vs. % Reflectance.

presented. It is clear that at a certain critical temperature a maximum intensity of the color of the crock was observed. The critical temperature has been shown in a previous paper (*7*), to be caused by rapid changes in the rate of absorption and penetration of the dye into the individual fiber.

When wool is dyed at low temperatures, 70°-150° F. the dye bath can be completely exhausted, but most of the dye will be concentrated on the outer parts of the fibers and will appear as rings of color when the dyed wool is examined in cross section. When this temperature is maintained for several hours or days, a good levelling acid color penetrates the fiber gradually, the rings slowly becoming thicker until they meet and the fiber appears to be completely dyed. With

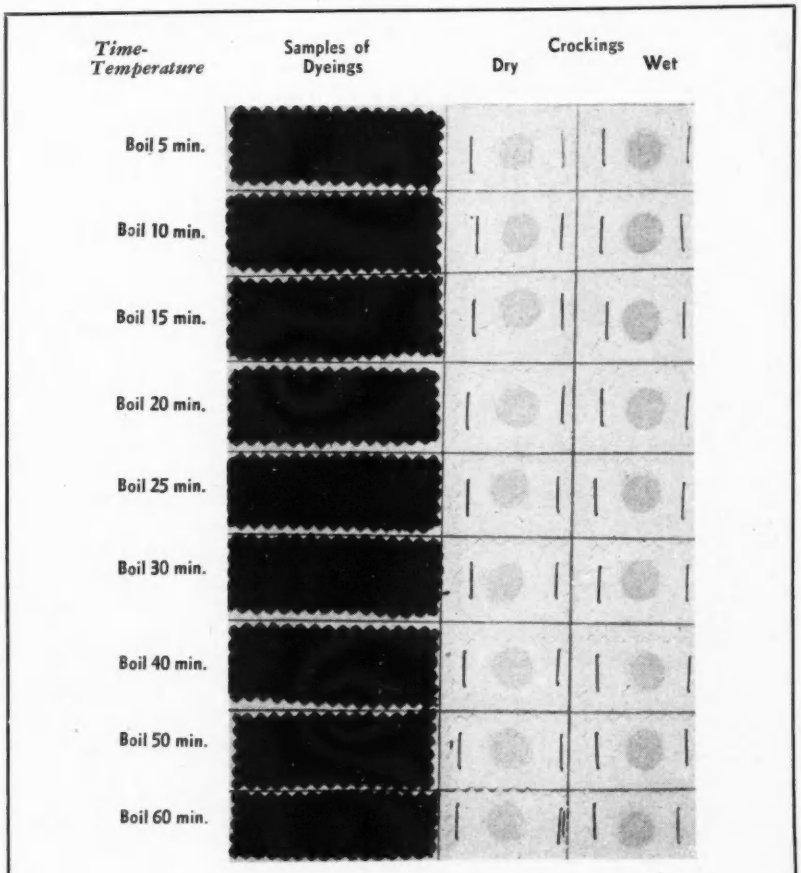


Fig. 14. Calcocid Milling Red BC Conc. Dyeing started at the boil.

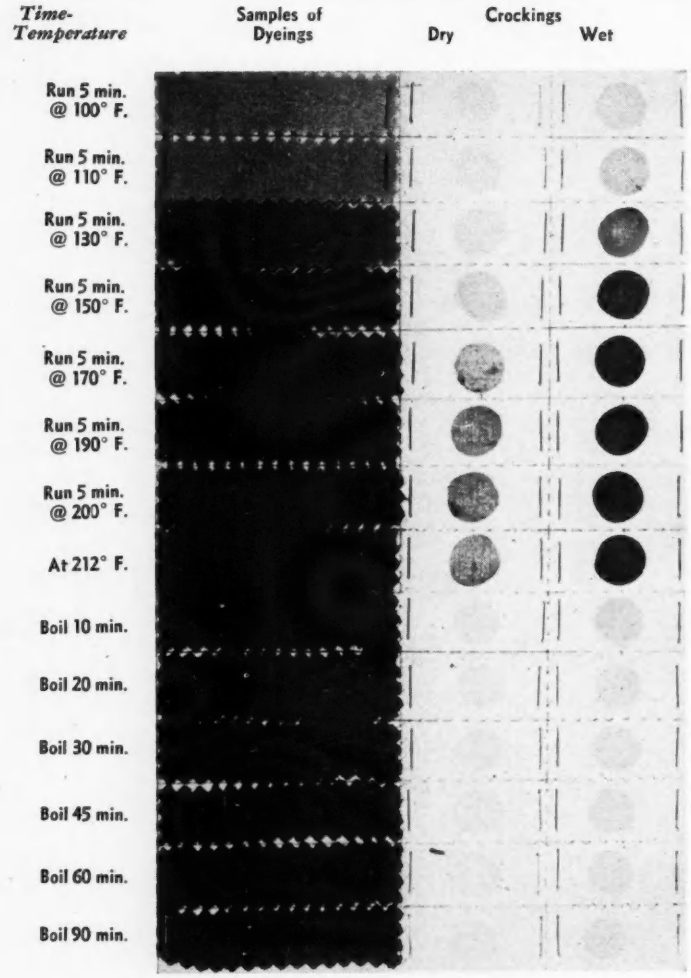


Fig. 15. Calcocid Milling Red BC Conc. Dyeing by standard procedure in presence of Cellosolve.

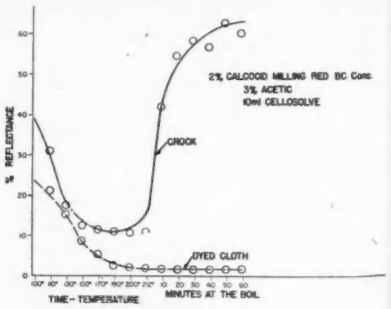


Fig. 16. Plot of Time-Temperature vs. % Reflectance.

certain colors several weeks may be required for complete penetration at low temperatures. In contrast to this, dyeings of the same colors started at the boil pass rapidly through ring formatoin to complete penetration in a comparatively short time.

Goodall and Hobday *(9)* have emphasized the temperature effect by describing a method in which the dyeing is started at the boil. In order to show the effect of this method upon crocking, a dyeing was made of Calcocid Milling Red BC, using 2 per cent dye, 10 per cent Calcined Glauber's salt, 3 per cent acetic acid 56 per cent, and a dye bath-cloth ratio of 60-1. The dyeings were started at the boil and samples were removed after 5, 10, 15, 20, 25, 30, 40, 50, and 60 minutes of boiling. Photographs of these dyeings and the dry and wet-crock tests are shown in Figure 14. Comparisons of these crock tests with those obtained from dyeings made by starting at a low temperature then raising to the boil (Figure 2) show that much better resistance to crocking was secured when the dyeings were started at the boil. The crocking was greatest for the sample which was boiled only 5 minutes and it decreased as the boiling was continued. The microscopical cross sections of the dyeings themselves, show that there was very little occluded dye in and among the fibers and that the dye which was exhausted onto the fabric, had penetrated into the individual fibers, fewer fibers being penetrated after 10 minutes (See color plate Figure 7) than after one hour on the boil (color plate Figure 8). These results seem to indicate that when started at the boil the dyeing does not pass through a critical crocking range. Instead the dye penetrates into the individual fibers as rapidly as it is exhausted from the dye bath. Thus, from the beginning, the build-up of color on the material is quite rapid and the crocking is less than that observed when the dyeing is brought to the boil slowly.

From this it would appear that at the boil, the condition of both the dyestuff and the wool are such as to favor rapid diffusion of the dye, into the individual fibers. Laboratory examinations have shown that both the fiber levelling and resistance to crocking were improved when the dyes were applied by this procedure.

Effect of Adding Solubilizing Agents

In contrast to the experiments with Glauber's salt in which the addition had a tendency to make the dye less soluble in the dye bath, other experiments were carried out in which organic agents which are believed to have a solubilizing or dispersing effect were added. These experiments have been discussed previously. Figure 15 shows the Cellosolve dyeing and the crocks made from these dyeings. Figure 16 shows the spectrophotometric reflectance values for these same dyeings and their wet crocks. These data should be compared with the results from the standard dyeings shown in Figures 2 and 8, which are the same except no organic material was added to the bath. It is evident that the critical crock point has been changed and made to occur at a higher temperature in dyeings where these organic materials are added. Such additions retarded the penetration and prolonged the period of ring dyeing.

Effect of Dye Concentration

In order to show the effect of dye concentration, a series of dyeings was made

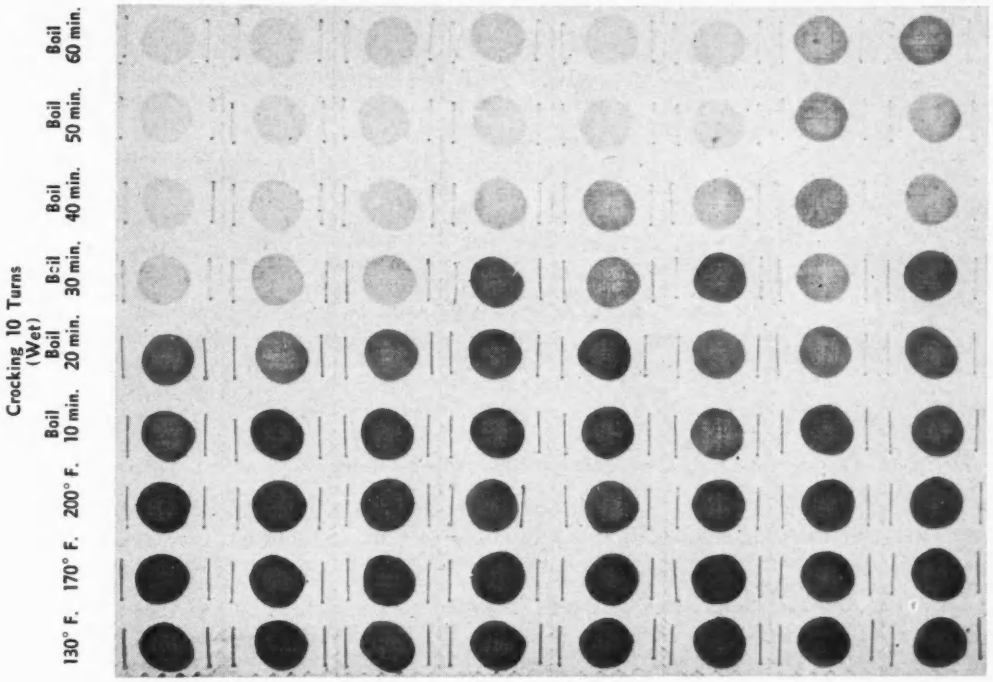


Fig. 18. Same as figure 17 except that there are wet crocks.

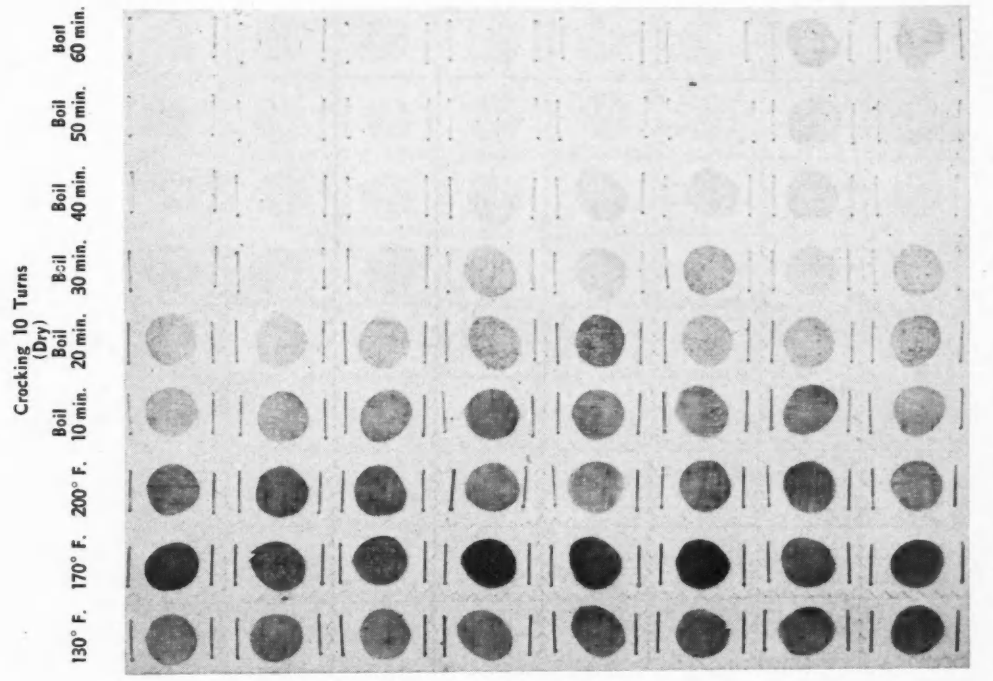


Fig. 17. Calcocid Milling Red BC Conc. Dry crocks for 8%-15% standard dyeings.

using Calcocid Milling Red BC at concentrations ranging from ½ per cent, 1 per cent and then in steps of 1 per cent up to 15 per cent. The wet and dry crock tests for the 8 per cent to 15 per cent dyeings are shown in Figures 17 and 18. Generally speaking, as the concentration of dye was increased the maximum intensity of the crock occurred at higher temperatures, or after longer periods at the boil. The critical crock point for a ½ per cent dyeing was obtained at about 170° F. For a 5 per cent dyeing, the critical crock point was about 200° F. At 15 per cent concentration, the intensity of the crock was rather heavy even after boiling for one hour. Certain individual crock tests were out of line in these experiments, but most of them followed the general pattern. Color Plate Figures 11 and 12 show the cross sections of the 2 per cent dyeings removed at 200° F. and after 1 hour at the boil, while Color Plate Figures 15 and 16 show the cross sections of the 15 per cent dyeings removed at the same time and temperatures. Comparison of the two concentrations at 200° F. shows dye deposited as heavier "rings" with the higher concentration.

Effect of Dye Addition

Toward the end of the dyeing operation, it is often necessary for the dyer to make additions of color to the dye bath in order to produce a match. These feeds are usually made at temperatures ranging between 180° F. and the boil. Although at these elevated temperatures, exhaustion of the dye takes place rapidly, it is important that sufficient dyeing time be allowed for the dye to penetrate properly, or the crocking fastness may be adversely affected.

Relation of Crock to Wash Fastness

Wash tests which were made on a number of time-temperature series of dyeings, showed that the bleeding and staining was related to the depth of crock for each temperature. For example, dyeings of Calcocid Milling Red BC stained increasingly heavy during washing until the maximum was reached at 190° F. This was exactly the same dyeing temperature which gave the heaviest crock. After this point, the staining became less as the crock became lighter in shade. This is a further confirmation of the work reported in a previous paper in this series. *(6).*

Influence of the Choice of Dyes

Each class of dyes used for wool, such as acid, milling, metallized, chrome, and direct colors has members which normally give dyeings good to crocking, while other members of the same class are not so good. In the following section, the effects of the methods of application of these dyes on their crocking properties are discussed.

1. Acid and Milling Colors

These colors are very sensitive to strong acid, such as sulfuric acid, especially when large amounts of dye are used for producing heavy shades. Thus, Calcocid Alizarine Blue SKY, C. I. 1088 is a dye which levels well from a weakly acid bath. It showed excellent crocks from start to finish of the dyeing operation as can be seen in Figure 19. It was dyed at 2 per cent with 10 per cent of calcined Glauber's salt, 8 per cent ammonium sulfate, and 1½% acetic acid 56 per cent added after boiling for 30 minutes. However, when this same color was dyed at 2 per cent, using 10 per cent calcined Glauber's salt and 4 per cent of sulfuric acid, wet and dry crocks were much heavier up to 150° F., Figure 20, and then the crock became progressively lighter, until the dyeing had boiled 60 minutes, at which time the crock was only slightly heavier than that of the dyeing made with acetic acid.

Most easily leveling acid colors penetrated readily and crocked very little when properly dyed. However, many of these same colors showed a critical crocking point when they were dyed in the presence of sulfuric acid. Examples of such colors are: Calcocid Orange, Y, C. I. 151, Calcocid Phloxine 2G, C. I. 31, Calcocid Alizarine Blue SAPG, C. I. 1054.

Time-temperature studies of a red-brown shade made with the 3 preceding level dyeing acid colors, i.e. 1 per cent Calcocid Orange Y Conc., 6 per cent Calcocid Phloxine 2G and 1 per cent Calcocid Alizarine Blue SAPG, 10 per cent calcined Glauber's salt and 4 per cent sulfuric acid, showed definite variations in the color of the crocks during the dyeing period. Cross sectional examination of the dyeings showed a definite correlation between the color of the crock and the dyes which had penetrated the fiber. Thus, in the early stages only an orange crock was obtained and only orange could be seen in the cross section. Later the crocks became brown due to the exhaustion of the red and blue which were also quite evident on the examination of the cross sections. Most milling colors showed greater sensitivity to acids than the acid colors discussed in the preceding paragraph. Calcocid Milling Red BC Conc., Calcocid Milling Orange GSC Conc., prototype 151; Calcocid Milling Blue BC; Calcocid Milling Red 7B showed critical crock points when acetic acid was used in the dye bath. However, Calcocid Milling Green CR, C. I. 735, showed no critical crock point when dyed neutral, but did show a critical crock point when sulfuric acid was used in the dye bath.

It is interesting to note that the color of the crock may be used as an indication of the sequence of exhaustion of each dye when a combination of colors is used. A series of time-temperature dyeings with milling and acid colors was made in which the following formula was used: 1 per cent Calcocid Milling Red G, C. I. 443, 1 per cent Calcocid Milling Yellow R, prototype 187, 1 per cent Calcocid Alizarine Blue SKY C. I. 1088, 10 per cent calcined Glauber's salt, and 3 per cent Acetic Acid, 28 per cent. The dyeings made at 100°-130° F. gave bluish crocks. At 150° F. the crock developed a definite reddish tone. From 170° F. to 10 minutes on the boil, the crocks were red and became progressively lighter and browner until 60 minutes on the boil was reached, at which time the crocks were very light. Cross sectional examinations again showed a correlation between the color of the crocks and the dyes which had penetrated into the fibers.

2. Calcofast Colors

Calcofast or chrome-metallized colors when dyed with sulfuric acid act quite similar to regular acid colors, in that they usually crocked heavier in the early stages of the dyeing operation. With continued boiling, the crock became lighter and finally it practically disappeared for many of the Calcofast colors. The Proprietary salts, such as Calcofast Salt MD, which are often used as dyeing assistants in the application of this class of dyes, increased the depth of the crock during the early stages of the dyeing operation. However, with a longer time at higher temperatures, the depth of crock gradually decreased until, for many colors it practically disappeared. The final crocks were lighter than those obtained from the corresponding dyeings made without the addition of Calcofast Salt MD. This can be explained by a more uniform and heavy deposition of the dye at the lower temperature and a more rapid and thorough penetration of the dye into all of the individual fibers, as the temperature was raised.

3. Calcomet (Meta) and Bottom Chrome Colors

Dyes applied by the Calcomet or by the bottom chrome processes may be deposited on the wool fibers as the unchromed or chromed colors. The dye is exhausted from the dye bath at the lower tempera-

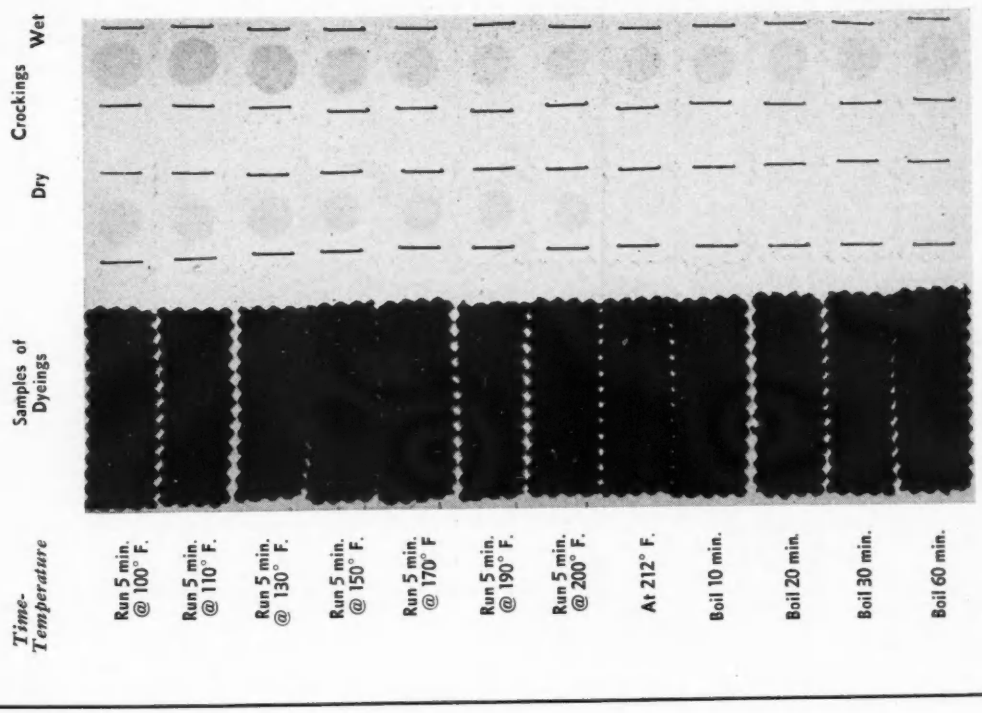


Fig. 20. Same as figure 19 but started with 4% sulfuric acid and 10% Glauber's salt.

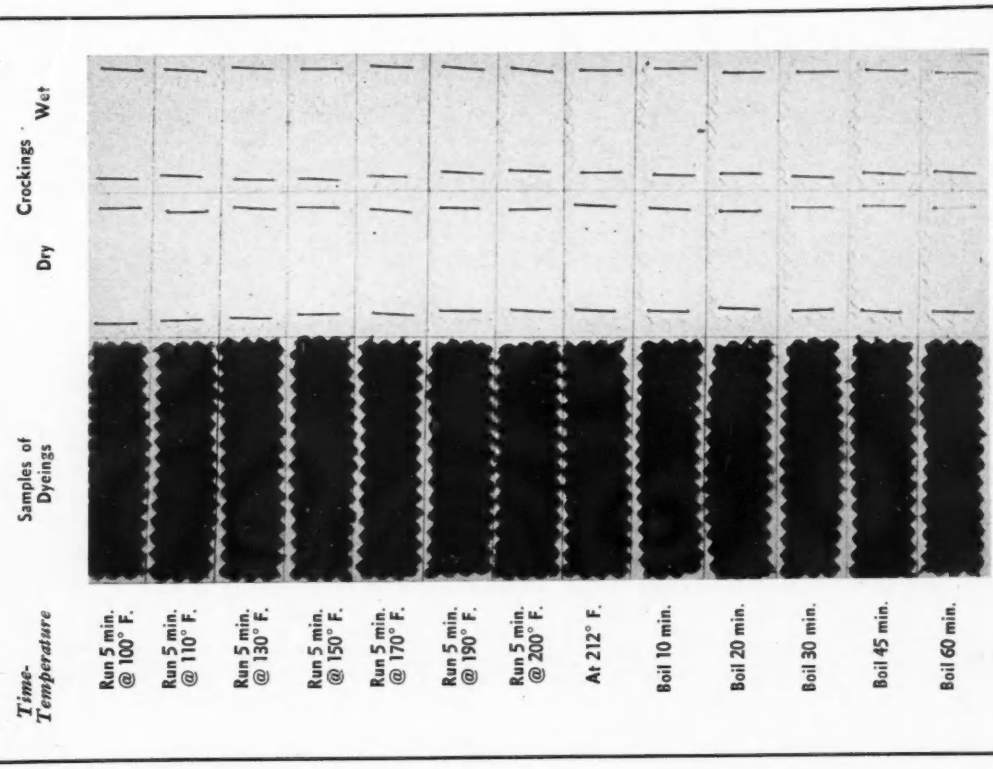


Fig. 19. 2% Calcocid Alizarine Blue SKY. Dyed with 10% Glauber's salt, 8% ammonium sulfate and 1½% of acetic acid (56%).

tures in the form of the unchromed color and then with increasing time and temperature the chromium complex of the dye is formed. Generally, the color of the crock was similar to that of the unchromed shade until 180° F. was reached. Between 180° F. and a boil for 15 minutes most dyes exhibited partial chromation and the color of the crocks was intermediate between the unchromed and chromed shade. From 15 minutes up to two hours on the boil the crocks were those of the chromed shade.

Cross sections showed that the dye which had been absorbed was similar in shade to that of the crocks obtained from the same time-temperature dyeings. This is illustrated by dyeings of Calcochrome Blue Black Conc., (C.I. 202), made by the Calcomet and bottom chrome procedures. The Calcomet procedure is a modified meta chrome method in which the dye bath is made up of 2 per cent dye, 2 per cent ammonia, 4 per cent Calcomet Mordant AR, 2 per cent Calcomet Salt L (Proprietary Products PAF), 2 per cent ammonium acetate and water to make the bath ratio 60:1.

The bottom chrome dyeing also was made at 2 per cent using 4 per cent ammonium sulfate in a bath ratio of 60:1. The wool used in these experiments was bottom chromed with 2 per cent sodium dichromate and 3 per cent refined tartar by boiling two hours. Examination of the cross sections of these dyeings showed the nature of the color developed with time and temperature. At 150° F. both the Calcomet and bottom chrome dyeings were ring-dyed showing the shade of the unchromed color. Color plate Figure 17 shows the cross section of the bottom chrome dyeing at 150° F. When the dyeings reached the boil the penetration of the dye into the fibers had increased and the shade had become much bluer indicating partial chromation, (See color plate Figure 18). After boiling 30 minutes, the shade had changed to a distinct blue and the penetration into the fiber was completed. Some fiber unlevelness was evident. After boiling for 60 minutes the shade was definitely blue, indicating the completion of the chromation, and the fiber levelness was good. Color Plate Figure 19 shows the cross section of the bottom chrome dyeing after this time at the boil.

Examination of the crocks from the dyeings showed the unchromed shade in the very early stages up to about 190° F. Beyond 190° F. the shade gradually became bluer, turning to a distinct blue during the later stages of the dyeing. The crocks obtained were those of the unchromed, partially chromed, and completely chromed shades.

Spectrophotometric measurements were made on the same Calcomet and bottom chrome dyeings and analyzed for per cent chromation by a method originated by Stearns and described previously *(10)*. The per cent chromation for each time-temperature dyeing follows:

TABLE I
2% CALCOCHROME BLUE BLACK CONC. (C. I. 202)

	BOTTOM CHROME		*CALCOMET*	
	Strength of Dyeing	*Percent Chromation*	*Strength of Dyeing*	*Percent Chromation*
Run 5 min. at 100 F.	11	0	9	0
Run 5 min. at 110 F.	21	0	15	0
Run 5 min. at 130 F.	37	0	24	0
Run 5 min. at 150 F.	59	0	49	0
Run 5 min. at 170 F.	77	3	69	2
Run 5 min. at 190 F.	83	12	93	5
Run 5 min. at 200 F.	88	26	104	15
At Boil	90	35	102	18
Boiled 10 minutes	100	67	98	50
Boiled 20 minutes	107	80	100	75
Boiled 30 minutes	112	85	97	88
Boiled 1 hour	100	100	100	93
Boiled 2 hours	100	100	100	100

The dyeing at 100° F. was assumed to be unchromed and the dyeing at two hours boil was assumed to be fully chromed and used as 100 per cent for strength of dyeing measurements. These data show that the bottom chromed dyeing is exhausted and chromed more rapidly at temperatures below 190° F. than in the Calcomet procedure.

Improper meta chrome procedures often result in poor fastness to crocking causing the deposition of a more or less insoluble chromium complex of the dye on the outside of the fibers. The formation of this insoluble chromium complex takes place rapidly at high temperatures and low pH. Therefore, when dyeing by a meta chrome procedure care should be exercised to control the pH and the temperature so that most of the dye is absorbed by the wool in the unchromed state. The unchromed dye can be exhausted from a dye bath which is slightly alkaline. The exhaustion is completed by gradually lowering the pH of the dye bath by means of careful additions of dilute ammonium acetate, sulfate, or acetic acid. Under these conditions, the desired chromium complex of the dye is formed within the fiber and thus is more resistant to crocking.

DIRECT COLORS

Class I

On the whole, there is a definite similarity in the dyeing properties of the direct colors on both cotton and wool. They may be divided roughly into three classes. The first class consists of those dyes which have a natural affinity for wool. Many of these dyes act toward wool in a manner similar to acid colors, exhibiting definite critical points as to their penetration and fastness to crocking. A typical example of this class is Calcomine Brilliant Yellow Conc. C.I. 365. A microscopical examination of a cross section as shown in color plate Figure 20, reveals a uniformity of dye distribution from fiber to fiber, with this color equal to that of an average level dyeing acid color. Dyeings and crock tests for this same dye are shown in Figure 21. When this color was dyed at 2 per cent with 20 per cent calcined Glauber's salt, or with 8 per cent calcined Glauber's salt and 2 per cent of acetic acid 56 per cent in a 60-1 bath, the critical points were reached early in the course of the dyeing process and were as sharp and as well defined as those obtained with Calcocid Milling Red BC. The crock was heaviest at 130° F. and considerably lighter at 150° F. The dyeings removed at 170° showed very little if any crocking and exhibited good penetration of the fiber when examined in cross section. Very little color development was observed until a temperature of 170° F. was reached, at which temperature the shade of the dyeing changed from a dull, weak, muddy yellow to a deep golden yellow. The development of color reached a maximum between 190° F. and 200° F. and changed very little on boiling for 90 minutes.

Calcodur Red 8 BL C.I. 278 which is often referred to as a boil off and on color, is another dye in Class I. Although spectrophotometric studies did not show variations in the degree of exhaustion of the dye bath, the dyeings removed after boiling 10, 20, 30, 45, 60 and 90 minutes showed periodic lighter and darker crocks, with increasing time at the boil. These results were so unusual that this series was repeated four different times under controlled conditions and each series showed the lighter and darker crocks to occur within the same 10 minute range. Apparently this dye repeatedly penetrated the fiber and then a portion returned to the surface only to again penetrate as boiling continued.

MICROSCOPICAL OBSERVATIONS OF WOOL DYEING
STUDY OF CROCKING

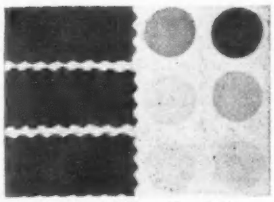


Fig. 1. Milling Red BC
Dyeings and Crocks
190° 212° Boil 1½ hour

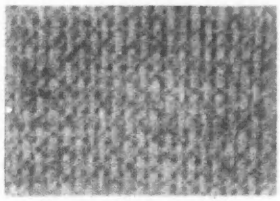


Fig. 2. Milling Red BC
Dry Crock (5X)

Fig. 3. Milling Red BC
Wet Crock (5X)

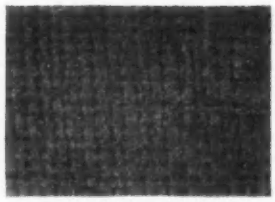


Fig. 4. Milling Red BC
Ethyl Cellosolve Crock (5X)

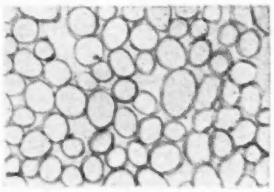


Fig. 5. Milling Red BC
Cross Section 190° F

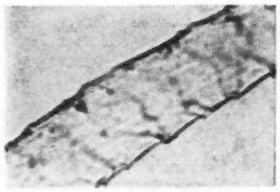


Fig. 6. Milling Red BC
Longitudinal View 190° F

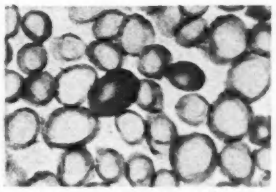


Fig. 7. Milling Red BC
Entered at Boil
Boil 10 minutes

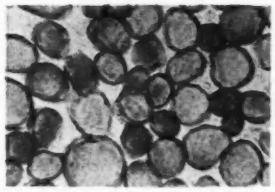


Fig. 8. Milling Red BC
Entered at Boil
Boil 60 minutes

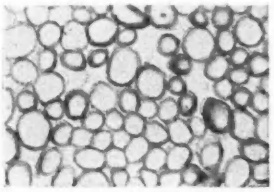


Fig. 9. Milling Red BC
Cross Section 212° F

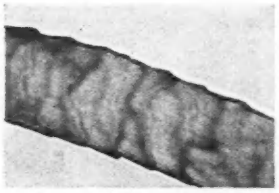


Fig. 10. Milling Red BC
Longitudinal View 212° F

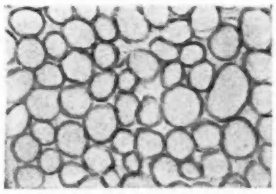


Fig. 11. Milling Red BC
2% Dyeing 200° F

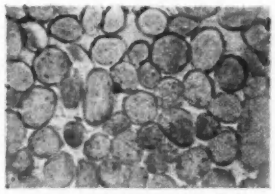


Fig. 12. Milling Red BC
2% Dyeing Boil 1 hour

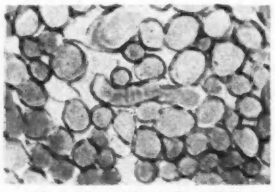


Fig. 13. Milling Red BC
Cross Section 1½ hour boil

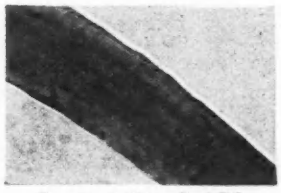


Fig. 14. Milling Red BC
Longitudinal view 1½ hour boil

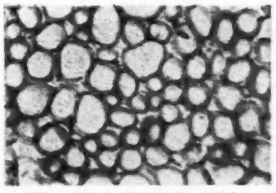


Fig. 15. Milling Red BC
15% Dyeing 200° F

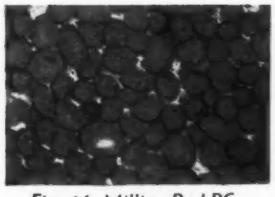


Fig. 16. Milling Red BC
15% Dyeing Boil 1 hour

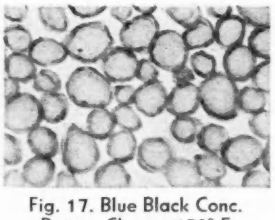


Fig. 17. Blue Black Conc.
Bottom Chrome 150° F

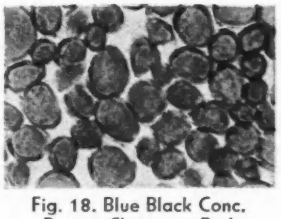


Fig. 18. Blue Black Conc.
Bottom Chrome at Boil

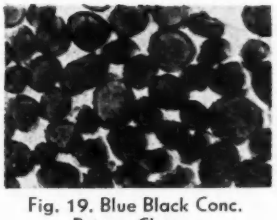


Fig. 19. Blue Black Conc.
Bottom Chrome
After 1 hour boil

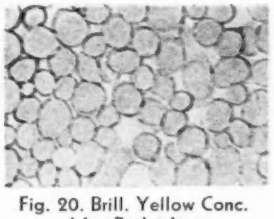


Fig. 20. Brill. Yellow Conc.
After Boil 1 hour

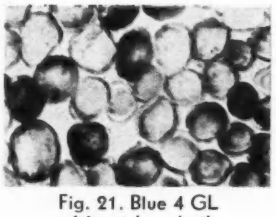


Fig. 21. Blue 4 GL
After 1 hour boil

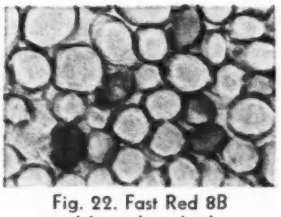


Fig. 22. Fast Red 8B
After 1 hour boil

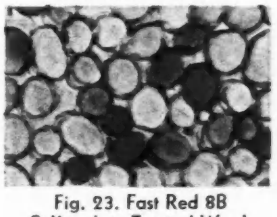


Fig. 23. Fast Red 8B
Sulfoxylate Treated Wool

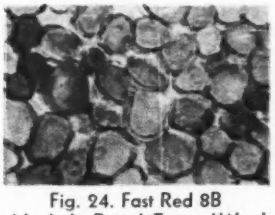


Fig. 24. Fast Red 8B
Alcoholic Potash Treated Wool

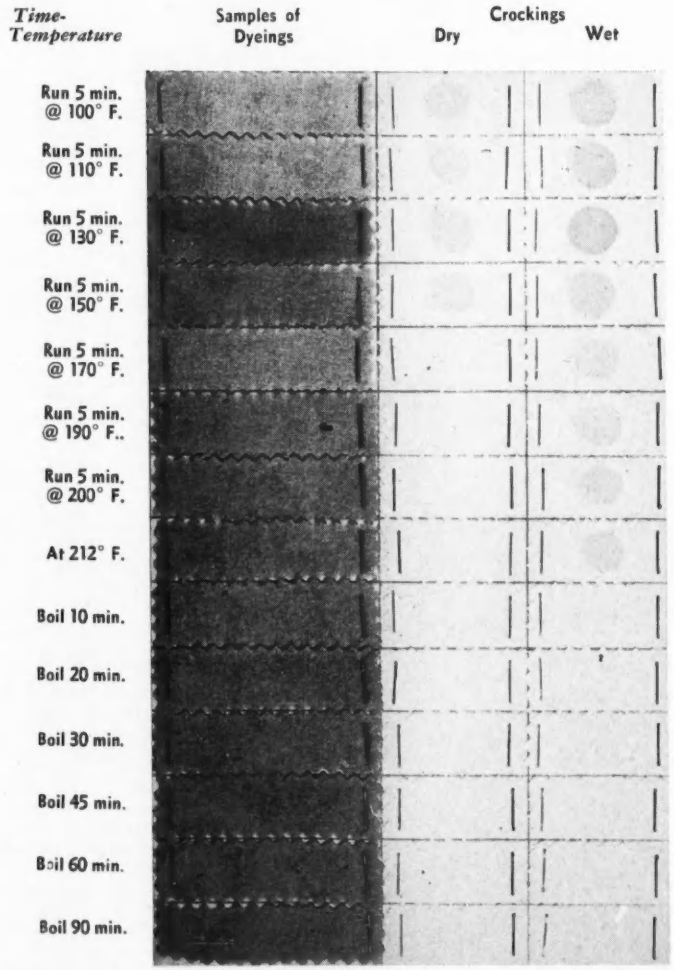


Fig. 21. 2% Calcomine Brilliant Yellow Conc. A class I direct dye.

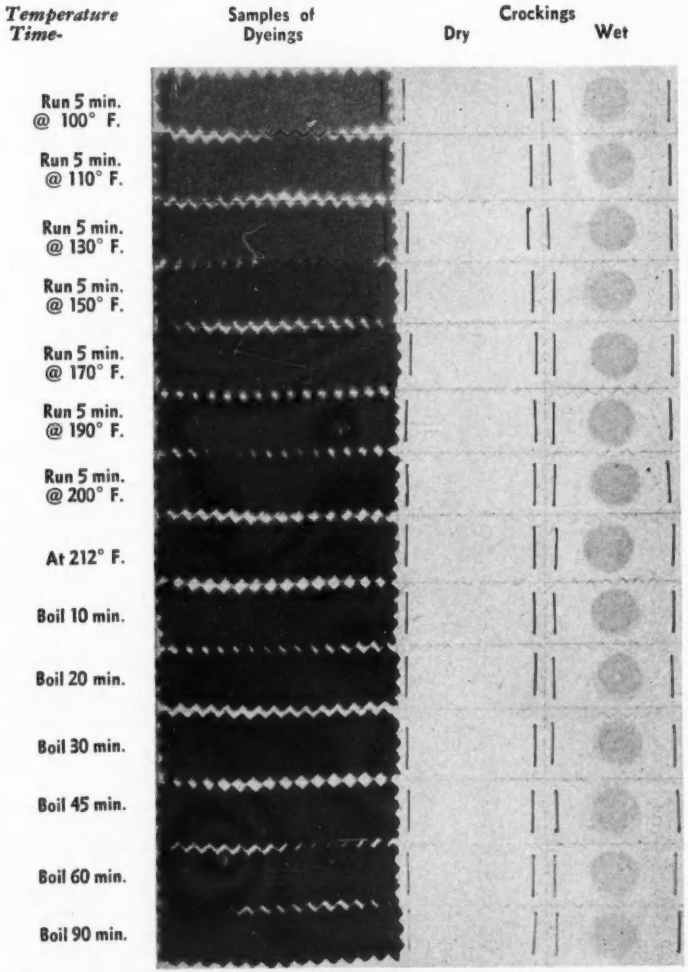


Fig. 22. 2% Calcodur Blue 4GL. A Class II direct dye.

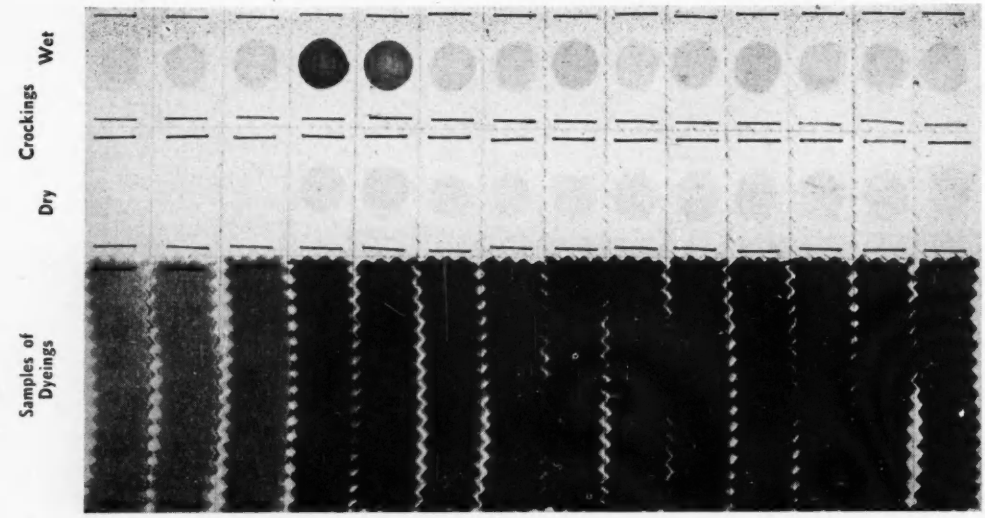


Fig. 24. Same as figure 23 but dyed neutral.

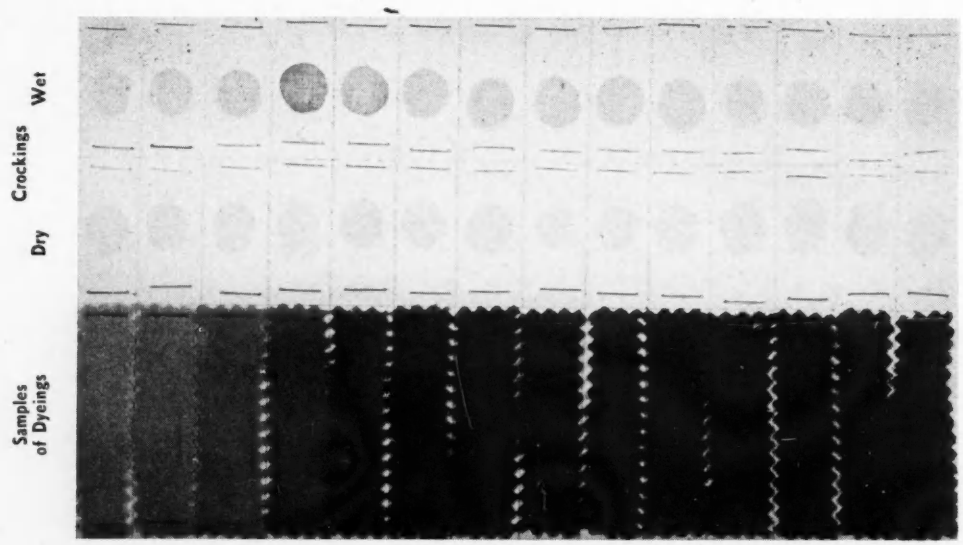


Fig. 23. 2% Calcomine Blue RW. Dyed with 2% of acetic acid (56%) and 20% Glauber's salt.

Class II

The second class of direct colors includes those dyes which have a greater affinity for cotton than for wool but color wool from a high temperature neutral bath. They also exhaust well from a slightly acid bath. Calcomine Garnet B C.I. 375 and Calcodur Blue 4GL C.I. 533 are typical examples of this type. They give a uniform crock throughout the entire time-temperature range. Figure 22 shows the dyeings and crocks for Calcodur Blue 4GL. The cross section of this dyeing shown in color plate Figure 21 is typical of a Class II color. The fiber levelness is seen to be somewhat less level than is generally obtained with milling colors.

Calcomine Blue RW C.I. 512 is another example of a Class II dye as shown by its dyeing characteristics but it does show a definite critical point. Calcomine Blue RW dyed at 2 per cent with 20 per cent Calcined Glauber's salt in a 60:1 bath reaches its critical point at the same temperature of 150° F. whether dyed neutral or from an acid bath containing 2 per cent of 56 per cent acetic acid based on the weight of the wool. Figure 23 illustrates the results of the acetic acid experiments while Figure 24 shows the neutral series. The acetic acid dyeings show better color values at lower temperatures than the neutral dyeings but after boiling 60 minutes both dyeings are rich in shade and approximately equal in depth of color. Acid dyeings give crocks which are definitely redder than those obtained from the neutral dyeings. Calcomine Blue RW exhausts to a reddish bath when acid dyed and the redness of the crock may be caused by the forcing on of this red component.

In the dyeing of Calcomine Green BT Conc., C.I. 589, the crocks obtained in the early stages are different in shade than those obtained when the dyeing is boiled 10 to 90 minutes. The crocks are bright bluish-green up to 212° F. but from this time on they become lighter, less heavily colored, and change to a yellowish-green. Particle or aggregate size of the dye may cause this change in hue.

Class III

The third class of direct dyes is made up of those colors which have no natural affinity for wool and have less affinity for cotton and rayon than do the members of Classes I and II. While acid will force the dye out of the bath and onto the fiber with poor penetrations, the crock becomes progressively heavier as the shade builds up. Calcomine Orange 5 RE C.I. 621, Calcodur Green BL, Calcomine Fast Red 8B and Calcomine Fast Rubine CA are typical examples of this class. Figure 25 illustrates the dyeings and crocks obtained with 2 per cent Calcomine Fast Rubine CA.

Dyeings and cross sections show that these colors are extremely fiber selective in their dyeing properties. This is illustrated by Color Plate Figure 22 which shows the cross section of a dyeing made with Calcomine Fast Red 8B. These colors do not level well and diffusion takes place readily only in those fibers which have been "damaged" by sunlight, weather, by mechanical operations, by some process such as by boiling with sulfoxylate, color plate Figure 24, by chlorination, or by treatment with the Freney-Lipson (11) alcoholic potash solution. This shows that the scale structure or the epidermis layer of the wool plays a very important part in the penetration and levelling of dyes.

The dyeing of the Calcomine Fast Red 8B on the sulfoxylate treated wool showed crocking properties like a Class II dye while the same dye applied to the alcoholic potash treated wool crocked like a Class III dye. Thus, the class into which a dye falls is dependent upon the condition of the wool.

There was considerable variation and overlapping of properties with different colors and no sharp line of demarkation between classes could be established. The class pattern into which a dye falls is dependent upon the condition of the wool and therefore the overall average dyeing properties on both cotton and wool determined the classification assigned to each dye. For example, Calcomine Blue RW exhibited definite reproducible critical

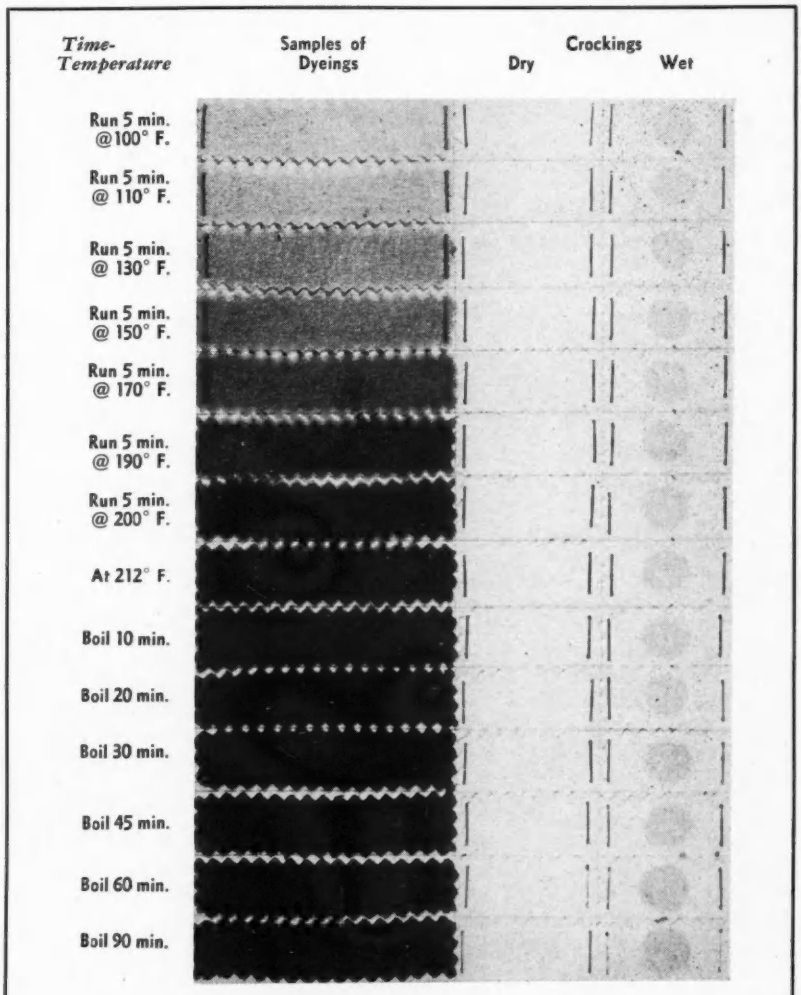


Fig. 25. 2% Calcomine Fast Rubine CA. A class III direct dye.

crocking temperatures which would place it in Class I but it does not dye cotton at low temperatures and therefore it was placed in Class II. It is interesting to note that Blue RW is the only color in Class II or III which exhibited sharp crocking points under normal dyeing conditions.

Basic Dyes

While basic dyes are not of great commercial importance in the dyeing of wool, it was thought that several dyes in this class should be studied by the time-temperature method so as to make this crocking study more complete. In all cases the dyeings were made using ½ per cent of dye and 1 per cent of acetic acid 56 per cent and the dyeings were removed at the same times and temperatures as in the previous experiments.

Dyes in this class exhibited the same extremes in their fastness to crocking as those found in other classes. Calcozine Yellow OX C.I. 655, Calcozine Flavine TG Ex. Conc., Calcozine Red BX C.I. 749 and Calcozine Orange YS C.I. 20 are fast to crocking, while Calcozine Red 6G C.I. 752, Calcozine Violet LR C.I. 680, Calcozine Green V C.I. 657 and Calcozine Blue XX vary from very poor to fair. In the case of Calcozine Red 6 GX Conc. the shade of the dry crock is definitely bluer than that of the wet crock. Calcozine Yellow OX exhibits on wool the same well-known phenomenon of color loss with rise of temperature and continued boiling that it shows in dyeing on cotton.

Influence of Preparation

Scouring and Rinsing

An improperly scoured fabric may retain a large portion of its natural, spinning, or processing oils and these cause excessive crocking. Too often these faults become apparent only after dyeing. Experiments have shown that the crock is composed of two materials, namely oils and dyes. When the dyed fabric was extracted with ether or carbon tetrachloride and the crock test repeated, the crock showed very little if any color. When the undyed and unscoured fabric itself was crocked before and after extraction a marked difference was noted. Dirt and oil present in the fabric before scouring stained the white crock cloth, while the extracted sample showed little or no staining. Any discoloration of the oil and dirt crock by dye or colored fibers greatly increased the apparent depth of color of the crock and made it appear as though the dye or dyeing procedure were at fault. Mohair, camel hair, cashmere, alpaca and similar animal fibers generally present greater dyeing and processing problems than wool with respect to crocking, since some of the natural oil is generally left in these fibers.

In order to study the effect of scouring upon the crocking of such fibers, a fabric composed of wool and a South American specialty fiber similar to Guanaco was obtained. This was crocked as it came from the loom, after scouring with soap and soda ash and also after a solvent extraction with carbon tetrachloride. Quantitative soxhlet analyses of the grease content of each of the above gave 10.1 per cent for the untreated, 5.8 per cent for the soap and soda scoured and 0.26 per cent for the solvent scoured material. Spectrophotometric measurements of the crocks using a value of 100 per cent for the soap-and-soda-ash scoured crock gave 135 per cent for the unscoured and 45 per cent for the solvent scoured sample. Dyeings were made by the usual acid, milling, Calcofast, and top chrome procedures and the crocks were measured on the spectrophotometer again using the soap scoured material as 100 per cent in each case. The crock values obtained for the solvent scoured material were 52 per cent, 52 per cent, 52 per cent, and 70 per cent respectively.

These tests emphasize the importance of removing completely the natural and spinning oils which increase the depth of crock. It is evident that the conventional scouring procedures which are adequate for most materials do not produce as satisfactory a result on these types of materials as does the solvent scour.

Effect of Hard Water

The hardness in water can cause a dyeing to crock excessively because of the precipitation of calcium and magnesium soaps during the scouring, or by combining with the dyestuffs to form an insoluble dye. In either case the dye does not penetrate properly and a surface deposition of color may occur. When only hard water is available, water softening agents and synthetic soaps can be used to advantage in preventing this difficulty.

Effect of Chlorination

Chlorination modifies wool and changes its rate of absorption of dyes. In this crocking investigation two chlorinated wool fabrics were studied. One was alkaline chlorinated under carefully controlled conditions at pH 10, while the other was chlorinated under similarly controlled conditions, but at a pH of 1.5 to 2.0.

Pieces of these two chlorinated fabrics were dyed by the time-temperature method described under general techniques with Calcocid Milling Red BC and both dry and wet crocks were made. An examination of the acid chlorinated dyed pieces and crocks revealed very rapid color development on the surface of the fabric with poor penetration of the dye into the body of the cloth. The affinity of the wool for the dye had been increased markedly and the dye was rapidly exhausted from the bath. The crocks showed the critical point to be at 170° F. with the crocking becoming only slightly better as the dyeing was continued. Even after boiling 1½ hours the fabric crocked badly.

The alkaline chlorinated wool dyeings and crocks were quite different from those just described. The color development was slow with good penetration of the dye into the cloth. The critical point again appeared to be at 170° F. but the crocking showed marked improvement as the dyeing continued. The 1½ hour boil dyeing gave much less crock than was observed in the case of the acid chlorinated fabric.

From these results it is apparent that the term chlorinated wool must be further defined when discussing dyeing results. Other conditions of chlorination and dyeing with a range of dyes have shown as great a variation as with the two examples described.

Effect of Carbonizing Prior to Dyeing

When properly controlled carbonizing has very little effect on the dyeing properties of the wool so treated. Unfortunately the carbonizing and neutralizing operations are often empirical and not accurately controlled, and therefore these processes may cause clouds, unevenness, and poor penetration of a fabric. If the soap used in scouring is not removed completely before the goods are carbonized, the carbonizing compounds will break up the soap and precipitate insoluble fatty acids in the fabric.

It is extremely difficult to neutralize completely a carbonized fabric in a short time without damage to the wool. This is especially true if the material is heavy or tightly woven. Materials containing strong sulfuric acid hold the acid tenaciously and passing the cloth through an alkaline bath often neutralizes only the surface of the fabric. When such fabrics are dyed, the acid from the interior neutralizes the alkaline portions of the material and changes the surface of the cloth from neutral or alkaline to acid. When

this occurs, the dye is exhausted rapidly from the bath and fixed on the surface of the cloth causing heavy crocking from the precipitated dye. If this condition is detected during the dyeing operation, sufficient ammonia to neutralize the cloth should be added to the dye bath. The dye will then be redissolved and solubilized so that exhaustion will proceed more slowly and levelness and penetration will be obtained.

When excessive quantities of alkali such as soda ash are used before dyeing to neutralize the acid remaining from the carbonizing process, the outer parts of the fabric may become damaged by the alkali which will also increase the affinity of the wool for dyes. Exhaustion again proceeds too rapidly and excessive crocking, unevenness and poor color development is noted. Starting cold with only Glauber's salt and ammonium sulfate in the dye bath will tend to control the rate of exhaustion, improve the penetration and prevent excessive crocking. Crocking studies have shown that the Calcofast wool dyes (metallized dyes) as a class are less affected by the variations of pH and fiber affinity than any other class of fast colors. These dyes can be applied to carbonized materials without previous neutralization and excellent crocks will be obtained.

Effect of Drying

Migration of color may occur when the dye is not completely fixed within the fiber. It is possible to have the dye diffuse out of the fiber into the surrounding water during the drying operation if the time of drying is prolonged. Migration of color causes a concentration or building up of dye on the outer exposed parts of a package or fabric. Since such dye has been removed from within the fiber and is deposited on the outside of the material, the crocks obtained from these areas are often excessively heavy. Quick drying with intense uniform heat rarely produces migration because it does not allow time for diffusion into the surrounding water to take place. Heavy shades are more liable to give trouble from migration than medium to light shades. Unequal drying from side to center may cause migration of color and variations in the depth of crooks from portions of the same piece.

A large number of drying tests were conducted using dielectric techniques. Wool and cotton packages, piece goods and skeins dyed with migrating colors were entirely free from crocking when dried by this method. Evidently the rate of moisture removal was so rapid and uniform from all parts of the package that movement of the dye from one section to another was prevented.

Effect of Shearing and Subsequent Finishing Operations

Shearing is essentially a mechanical operation but it may seriously affect the crocking fastness of colors on various fabrics. Well dyed, crock free fabrics will often crock excessively after shearing, but this is not the fault of the dye or of the dyeing procedure. The material which is rubbed off is composed of short lengths of loose fibers. These loose fibers are picked up and forced into the spaces between the threads when the crock cloth is rubbed over the surface of the fabric. Spectrophotometric measurements of the crocks made before and after shearing showed a large increase in the depth of color obtained from a sheared fabric. Microscopical examination of the crocks obtained from sheared fabrics showed that the crocks were heavily colored, not because loose dye had been removed from the fiber but because powdered colored fibers were accumulated by the undyed test cloth while travelling over the surface of the sheared dyed fabrics. This type of crock is readily detected under the microscope and should not be confused with dye crocks. Dye deposited on the fibers is difficult to remove by mechanical operations, but the loose fibers resulting from shearing usually can be removed mechanically by brushing, shaking, or suction. Blowing, dusting, and other mechanical actions help to remove this colored wool dust. Therefore, the crocking is reduced by these operations.

For example, crock tests were run on a heavy black woolen fabric after dyeing, after shearing, and when completely finished. This fabric had been dyed properly as was shown by the excellent crocks obtained from the rough dried piece. After shearing the crocks were much heavier and the subsequent finishing operations did not eliminate or reduce the depth of crock. Microscopical examination of the three sets of crocks showed a few short fiber lengths embedded between the fibers in the threads of the cotton cloth. However, the crocks obtained from the sheared and finished fabrics were not darker because of the presence of a greater number of embedded black fibers. The crocks were darker because the white cotton fibers had accumulated a very finely divided black substance which reduced the reflectance of the white fibers. A possible explanation of the difference in crocks between unsheared and sheared may be in the greater number of dyed fibers which come in contact with the cotton cloth during the crocking test. The unsheared fabric has fibers which form a mat over the main body of the cloth and those are removed by the shearing operation. This removal would allow the crock cloth to contact the body proper of the cloth and therefore remove dye from a much greater number of threads and fibers.

Summary

The microscopical studies discussed in this paper all showed that the dye which rubbed off was located on the outer parts of the wool fibers. Dyeings that were made to determine the effect of dye concentration showed that as the concentration of the dye was increased the crocks became heavier and an increasingly longer boiling time was required for the available dye to penetrate and gradually reduce the depth of crock. Any excess of dye which cannot penetrate the fibers within a normal dyeing cycle is easily removed during a crock test. Even well-dyed medium shades produced with acid colors often show some crock. This type of crock cannot be attributed to improper methods of application when the dye is applied by methods which have proved satisfactory over a long period of time. Electron photomicrographs of the surfaces of dyed wool showed that deposits of dye were on the surface of the fibers before the boil was reached, and concentrated in the areas where the scales joined. Apparently, this dye redissolved with time or temperature, either in the wool fibers directly or in the water phase surrounding the fibers and penetration was accomplished. However, some crock was obtained in most cases because not all of the dye redissolved and some of it remained on the surface throughout the entire dyeing operation. The greater the number of dye particles remaining the heavier the crock and this appears to vary with the individual dye and the method of application.

Based on the above, it is easier to understand the reasons for the success of the old, established methods for the correction of crocking faults. These methods generally employ mechanical action, such as squeeze rolls and fulling mills, or agents such as soaps and alkalies. All of these have a beneficial effect in removing loose dye from materials. Passing through squeeze rolls gives the necessary friction and rubbing effect while soaps and alkalies redissolve or loosen the adhering unfixed colors and facilitates its removal.

(Continued on Page 69)

Intersectional Contest

Some Aspects of the Saponification of Acetate Rayon*

Presented by
SOUTH CENTRAL SECTION

COMMITTEE

C. E. Bachelder, *Chairman*
Max Y. Parker
Dr. F. D. Pilgrim
Speaker
Dr. F. D. Pilgrim
Judge
J. D. Mosheim

ABSTRACT

There are many factors which affect the rate of saponification of cellulose acetate rayon. Among these are the source of the cellulose acetate, the chemical nature of the saponifying agent, the concentration, the time of exposure, and the temperature used. Two types of saponification may be obtained with all possible gradations between them. There is the surface or superficial type, and the diffuse type. Cross-sections have been prepared showing the sharp line of demarcation which can be obtained when the surface saponification is carried out. The effect of time, temperature, and concentration on the reaction rate when sodium hydroxide is used is also shown. A number of alkaline agents were tested at various pH values and temperatures, and the type of saponification given by each is shown by means of dyeing the fibers and preparing cross-sections. In general, it has been shown that the saponification reaction can be controlled to give the desired results with a minimum of cost and effort provided proper care is exercised in selecting the saponifying agent and the conditions for the reaction. It is also pointed out that care should be taken in applying these laboratory results to commercial practice.

THE saponification of cellulose acetate rayon has been of considerable interest to dyers and finishers since the production of this fiber was started. At first it was of importance because of the dearth of dyes which had a direct affinity for cellulos acetate. However, in a very short while the organic chemists had synthesized an almost complete range of colors which, although insoluble in water, could be dispersed and applied directly to cellulose acetate yarns. These colors were not completely satisfactory for several reasons. They varied considerably in their fastness to light, washing, dry cleaning, perspiration, atmospheric or gas fading, and numerous other factors conducive to fading or color change.

Commercially, the application of saponification processes to cellulose acetate is usually done for one of two principal reasons; first, to enable the cellulose acetate to be dyed with direct cotton dyes, and second, to improve the mechanical properties of the fiber, by means of stretching in conjunction with saponification. An outstanding product of this process is Fortisan, but it is with only the first application that this paper will deal.

In order to try and overcome some of the difficulties mentioned above, many fabrics have been dyed over the past twenty-five years by means of saponification and the use of direct cotton colors. One excellent reason for this procedure was that there were no colors for acetate which could be discharge printed and still produce a clear sharp pattern and it is only within the past few years that such acetate colors have been produced. In the process of dyeing saponified acetate with direct colors, there are two distinct processes which must be recognized. First, the fabric must be saponified so that there is an affinity for direct colors, and secondly, if these colors are to be discharge printed the fabric must be capable of rapid swelling and wetting in order to produce clear sharp patterns.

Our interest in this problem of saponification started about 1935 or 1936 when discharge printed crepes having an acetate warp and viscose filling were very much in vogue. A study of these fabrics showed a definite lack of control of the saponification process as it was then being carried out. For example, whereas the normal acetyl content of cellulose acetate rayon is 39.25% it was found that four pieces of fabric from one finishing plant were saponified to different degrees as shown in Table I.

TABLE I

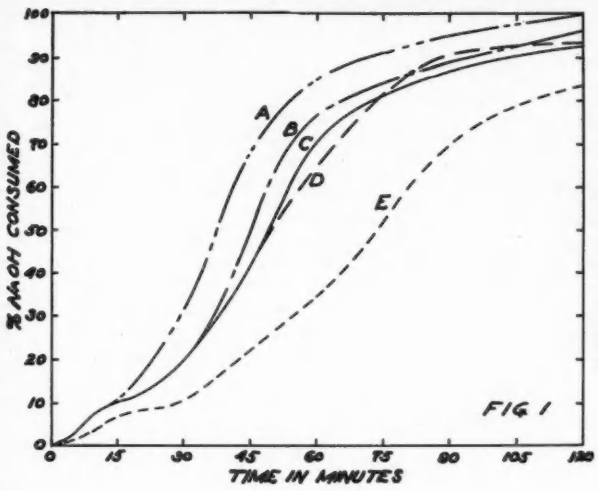
	Per Cent Acetyl Content
1	26.6
2	18.3
3	27.9
4	30.0

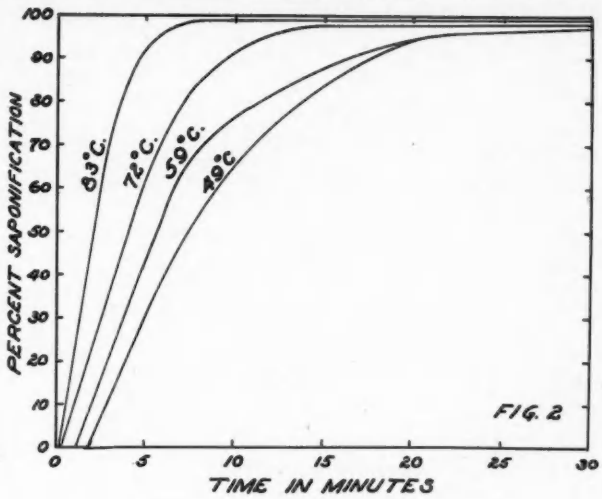
This variation is amazing when one considers that these pieces were finished in one plant and presumably by the same process. Further inquiry showed that there were just about as many variations in the saponification process and the agents used as there were finishers, and all of these had their own pet formula and procedure. Most of these appeared to be based on empirical experience and not on any detailed study of the factors involved in the saponification reaction. While the reaction itself is a simple one involving the splitting of an ester by a hydrolyzing agent there are many variables which affect the speed and extent of the reaction with a resultant effect on the dyeing properties and fabric properties of the finished goods. These all-important factors are:

1. The type of cellulose acetate.
2. The saponifying agent.
3. The volume of the saponifying bath.
4. The concentration of alkali in the saponifying bath.
5. The temperature of the saponifying bath.
6. The time of exposure to the saponifying bath.

The work being described was undertaken to study the effect of some of these variables on the saponification reaction to determine the optimum conditions for saponifying cellulose acetate so as to obtain the desired extent of saponification in the shortest possible time and with a maximum of control over the reaction. It was well recognized that there are two general types of saponification with all possible gradations from one to the other. Either the saponification may be concentrated at the surface of the fiber or it may be "diffuse saponification" evenly distributed throughout the fiber. It is with the former that we

* Presented at Intersectional Contest Silver Jubilee Convention, Hotel Statler, Boston, Mass., December 13, 1946.





are principally concerned, since any treatment designed to alter the dyeing properties is less costly in time and reagent if the outer surface alone is altered to take up the dye.

In order to carry out this program we found it necessary to develop a rapid and accurate method for the determination of acetyl content, since the ordinary methods would not be applicable because of the presence of saponified material in some cases, and the length of time required in other cases. This method is described in detail in a paper to be published in the near future, but briefly, it consisted of completely digesting the specimen to be analyzed for acetyl content with 2N hydrochloric acid and measuring the increase in acidity of the resultant solution. This method was found to be equally as satisfactory as the sodium hydroxide method which requires more than twenty-four hours and the analysis by the hydrochloric acid method can be completed by a skilled analyst in three to four hours.

Preliminary experiments indicated that caustic soda would be the best reagent to use for the purpose of this study since it could be easily handled, easily titrated, and the reaction was rapid. In much of this work with the various times and temperatures, therefore, some variables were eliminated by restricting the cellulose acetate to Eastman 150 denier bright acetate rayon and the saponifying agent to caustic soda. The preliminary work had also indicated that the use of sodium hydroxide alone was conducive to surface saponification which is generally desirable.

Effect of Acetate

To demonstrate that the source of cellulose acetate does have a pronounced effect on the saponification reaction, some experiments were run in which four domestic and one foreign cellulose acetate yarns were submitted to what may be called the "Resistance to Boiling Alkali" test. This may be taken as a measure of the stability of the cellulose acetate or the resistance to saponification. The acetates produced in this country today are quite stable when one recalls that only a few years ago many fabrics were delustered commercially by boiling in soap solution.

In this "Resistance to Boiling Alkali" test only sufficient caustic soda is added to give 9% saponification. The solution is brought to a boil under a reflux condenser to keep the volume constant. These conditions tend to give a surface saponification to the specimens under test. A number of specimens are run simultaneously and one is taken off at various intervals of time. Figure 1 shows the relative stabilities of four domestic acetates and the one foreign acetate tested. This relationship is borne out in actual commercial practice also for it is a known fact that the foreign acetate shown in Figure 1 as Curve A is satisfactory for the so-called "Burn Out Printing" process, whereas, the others are less satisfactory. Thus the source of acetate should be given consideration when one desires to saponfy it, since it is obvious that the acetates from different manufacturers behave differently with respect to alkali under the same conditions.

Effect of Time and Temperature

1. *When an Excess of Alkali is Used:*

The procedure in collecting these data was to use caustic soda equal to 50% of the weight of the oven dry cellulose acetate dissolved in a forty to one volume of distilled water, the volume also being based on the weight of the acetate. This solution was placed in a constant temperature bath held at the desired temperature and allowed to come up to temperature after which the acetate was introduced. Means were provided for agitation and when the proper time had elapsed the sample was removed, washed, and thoroughly dried. The degree of saponification was then determined. These series of experiments were made at temperatures of 49°C., 59°C., 72°C., and 83°C., all temperatures being controlled within plus or minus 1°C. The results are shown in Table II.

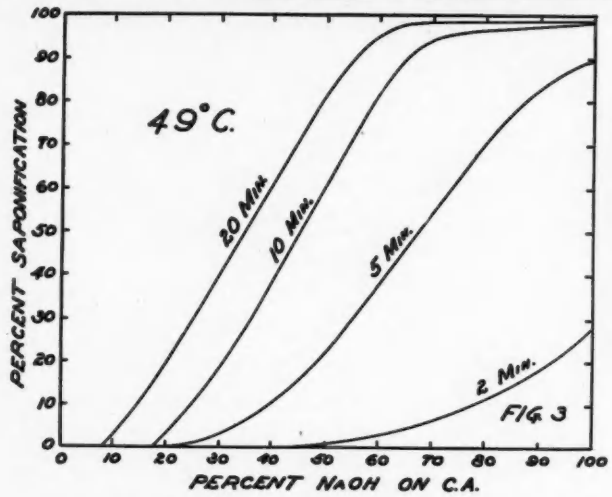
TABLE II

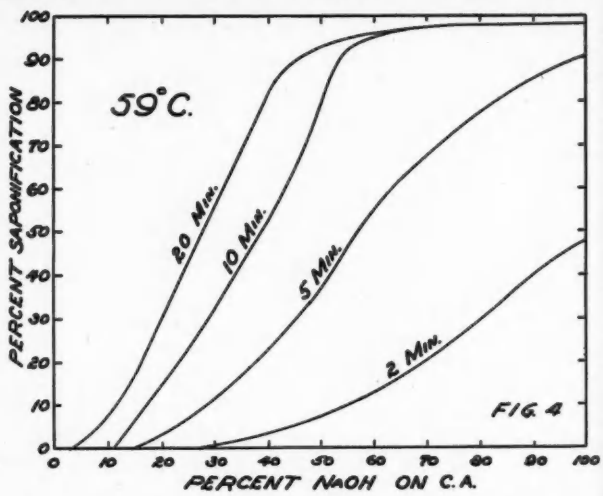
Time in Minutes	Per Cent Saponification 49°C.	59°C.	72°C.	83°C.
½	0	0.6	0.2	7.9
1	0	0.8	9.8	16.5
2	1.4	8.8	26.2	65.5
3	9.9	18.3	35.7	...
5	29.8	51.0	67.2	85.5
8	60.9	69.0	82.9	98.9
10	62.6	76.5	91.9	98.5
15	82.0	87.5	98.5	99.0
20	94.5	94.5	...	99.0
30	97.1	97.5	98.0	99.0

The same results are shown more clearly in Figure 2. This chart demonstrates the great rapidity with which the saponification reaction takes place at four temperatures with an excess of alkali present. Most commercial processes attempt to saponify the cellulose acetate more than 10%, in order to obtain even dyeings. Note that at 83°C. and also at 72°C., this point has been passed in less than one minute which means that any process employing an excess of alkali and high temperatures would necessarily require that the reaction time be closely controlled.

2. *Effect of Concentration of Alkali:*

Four series of tests were run in which the amount of caustic soda was varied from two per cent to one hundred per cent based





on the weight of the cellulose acetate. The same temperatures used above were adhered to and for each series the time was held constant. References to Tables III, IV, V, and VI should be made for the results of this series of experiments. The results are shown graphically in Figures 3, 4, 5 and 6. With a fairly high concentration of caustic there is little effect on the acetate at temperatures below 59°C., but at higher temperatures the reaction begins almost at once. With the assistance of the data shown by these curves one may use discretion in selecting the proper conditions of time, temperature, and concentration so as to obtain the desired amount of saponification most economically and with the greatest possible control.

It is realized, of course, that all of these conditions will not be useful, but it would seem to be just as important to know what conditions *not* to use, as it is to know what ones can be satisfactorily controlled.

To illustrate, a series of tests were run in

TABLE III

Conc. NaOH % on Wt. C.A.	Per Cent Saponification at 49°C— 2 Mins.	5 Mins.	10 Mins.	20 Mins.
0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0
20	0.0	0.1	3.0	21.0
30	0.0	3.0	17.4	41.9
40	0.0	20.0	41.6	65.5
50	1.2	27.4	60.2	82.4
60	2.9	38.8	69.1	95.0
70	6.7	52.4	94.3	98.5
80	12.8	70.0	96.6	98.4
90	18.0	83.0	97.8	98.4
100	28.0	...	98.5	99.0

TABLE IV

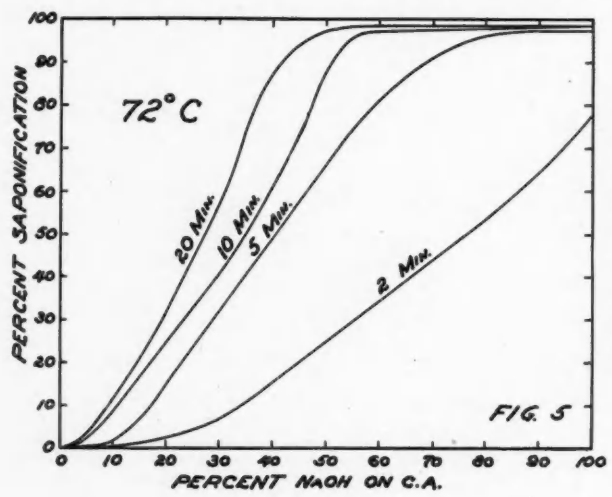
Conc. NaOH % on Wt. C.A.	Per Cent Saponification at 49°C.— 2 Mins.	5 Mins.	10 Mins.	20 Mins.
0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	3.7
10	0.0	0.0	0.0	7.1
20	0.0	2.7	14.1	30.1
30	1.3	13.1	32.8	55.3
40	2.7	23.1	52.4	82.9
50	8.0	37.0	80.0	92.2
60	15.7	56.0	95.0	97.3
70	30.2	66.5	96.8	97.5
80	...	69.5	98.1	98.4
90	46.1	84.5	...	98.3
100	43.5	90.6	...	98.3

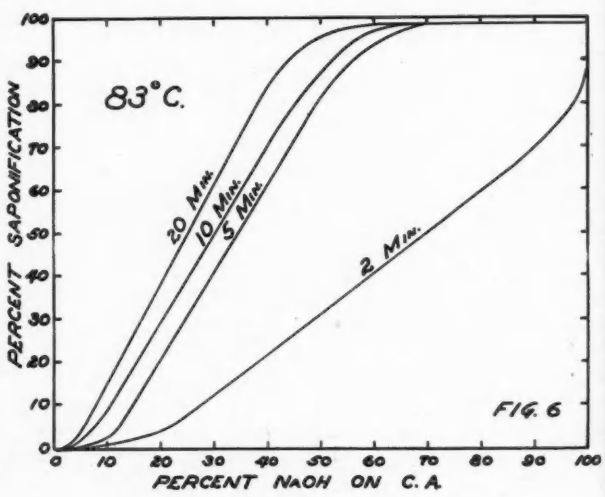
TABLE V

Conc. NaOH % on Wt. C.A.	Per Cent Saponification at 72°C.— 2 Mins.	5 Mins.	10 Mins.	20 Mins.
0	0.0	0.0	0.0	0.0
2	0.5	0.2	0.4	0.4
5	0.4	0.6	1.9	3.4
10	1.4	1.7	8.4	11.2
20	1.5	15.1	24.1	30.7
30	6.6	33.3	40.6	56.9
40	10.8	49.0	61.5	87.1
50	29.6	77.0	87.5	97.5
60	35.3	81.5	97.3	98.5
70	44.5	91.0	97.5	99.0
80	52.6	96.3	97.5	99.0
90	52.5	97.5	98.5	98.5
100	76.9	97.5	98.5	98.5

TABLE VI

Conc. NaOH % on Wt. C.A.	Per Cent Saponification at 83°C.— 2 Mins.	5 Mins.	10 Mins.	20 Mins.
0	0.0	0.0	0.0	0.0
2	0.3	0.3	2.2	1.5
5	1.0	0.7	...	4.0
10	...	2.4	8.8	16.4
20	1.8	21.1	33.2	35.7
30	13.3	38.2	50.0	71.4
40	23.8	58.5	70.4	83.3
50	31.7	81.6	85.1	95.3
60	46.3	92.3	97.1	98.8
70	45.6	98.4	98.5	97.8
80	64.0	98.2	98.5	97.8
90	78.9	98.8	98.5	98.6
100	88.2	98.4	99.0	98.5





which arbitrary desired acetyl values were selected. Table VII shows the results of these tests:

Table VII

Per Cent NaOH Used	Desired Acetyl Value	Acetyl Value Found
2	38.0	37.9
5	36.0	36.0
8	33.0	33.7
10	31.0	31.3
12	30.0	30.4
15	28.0	27.2
20	23.0	22.4

Actually these tests were carried out at a temperature of 96°C. because of the extreme speed of the reaction at higher temperatures. The reaction was carried out until the pH of the solution dropped to 8.5 or lower at which time the reaction would be over 99% complete. This shows that consistent results can be obtained if proper attention is given to the factors controlling saponification.

Further tests showed that it is entirely unnecessary to carry saponification to extremes in laboratory practice. It was found that if cellulose acetate rayon is saponified to an acetyl value of approximately 37% to 38% that the same shade with Cotton Blue FF will be obtained as with Viscose Rayon, but care should be exercised in translating these results into commercial practice because of the influence of twist, tension, construction, etc.

It is desirable to note that the acetyl values reported in this paper are average values for the whole cross-section of the fiber and do not represent the acetyl content of the saponified outer layer. As mentioned above, if it is merely a matter of matching shades on acetate and viscose, it is necessary only to saponify the surface so that an average acetyl value of 37% to 38% is obtained. It is important to note that other considerations may necessitate greater saponification for certain specific purposes, but referring to Table I which shows actual commercial saponification, it seems rather a waste of time and saponifying agent, to say nothing of the loss of the properties of cellulose acetate, to carry the hydrolysis to such extremes when it is not necessary to obtain the desired results.

It apears from this work that the saponification of cellulose acetate by caustic soda is a surface phenomenon and this can be clearly shown by means of dyeing and preparing photomicrographs.

Effect of Saponification on Physical Properties

It was found that the temperature at which the saponification reaction is carried out had very little effect on the physical properties of the acetate.

In general, the following conclusions were drawn as to the effect on physical properties of increasing saponification:

1. There is a gradual decrease in both wet and dry stretch, the loss in the wet stretch being greater. The dry stretch dropped from 26% to 21% at 40% saponification while the wet stretch dropped from 38% to 27%.
2. There is essentially no change in the dry tenacity up to 40% saponification, but the wet tenacity is decreased to 50% of its original value. It is to be remembered that while this is true of the tenacity, the overall strength per end of yarn or per inch width of fabric would be decreased because of the loss of weight.
3. The moisture regain increased as would be expected, becoming about 11% at 40% saponification at laboratory conditions of 70°F. and 65% relative humidity.

It is believed that the great effect of saponification on the wet tenacity and elongation is explained by the fact that the saponified fiber is more susceptible to wetting and swelling by water than before saponification took place.

Other Saponifying Agents

For a long time there has been some question among finishers as to whether the addition of certain assistants to scouring or finishing baths was injurious to the properties of cellulose acetate rayon. Some argued that if the pH of the bath was kept down there would be no deleterious effect. In order to answer this question, a series of tests was carried out using a number of alkaline agents at pH values of 8, 9, and 12 or as close as could be obtained in laboratory practice. Each test was run in duplicate at temperatures of 71°C. and 88°C. for 5, 10, and 30 minutes.

The results obtained were somewhat surprising in view of published data. The effect of the various agents is shown in Table VIII. Although carried out at times of 5, 10, and 30 minutes, there was essentially no effect at the shorter times, therefore, only the results obtained at 30 minutes treatment are given. Figure 13 shows graphically the relative activity of the same alkalies given in Table VIII. Note that although the pH value is essentially the same there is a tremendous variation in concentration, and the activity as a saponifying agent is not proportional to concentration or pH value, but upon the nature of the alkali.

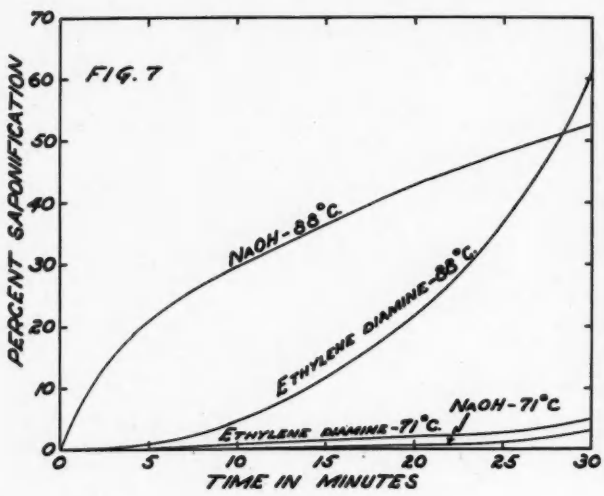
The normal acetyl value for the cellulose acetate used is approximately 39.25%. Values in the table which vary from this value by 0.5% or less may be assumed to be due to experimental error. This work seems further to indicate the remarkable stability of the present day acetates. The data from which Table VIII was prepared showed that there is an initial period of resistance to saponification, but once the reaction has started it proceeds quite rapidly. This can be partly explained by the fact that as saponification starts there is little swelling of the fiber and little more than the actual surface available for the reaction to proceed. However, as the saponification proceeds more swelling takes place with a consequent increase in the rate of saponification.

Figure 7 is interesting in that it shows the difference in the rate of reaction of caustic soda and ethylene diamine. As has been pointed out before, the reaction with caustic soda is preeminently a surface reaction. On the other hand the saponification by ethylene diamine is an almost completely diffuse saponification as will be shown by means of photomicrographs. In Figure 7 note that the sodium hydroxide curve shows a rapid rate of saponification while there is very little effect on the acetate by the ethylene diamine. Note also the tremendous effect of temperature on the speed of both reactions. The delay in the start of saponification by the ethylene diamine is believed to be due to the time required for swelling the fiber.

These data demonstrate rather conclusively that it is not pH *per se* which controls the saponification reaction, but that what is more important is the nature of the

TABLE VIII

Agent	pH	Concentration % by Weight	Acetyl Values After 30 Mins. Treatment 71° C.	88° C.
Neutral Soap	8	0.005	39.3	39.6
	9	0.04	38.9	39.5
	9.9	0.10	39.5	39.8
Trisodium Phosphate	8	0.00074	39.5	39.2
	9	0.0034	38.8	39.1
	8	0.000337	39.3	40.1
Sodium Carbonate	11.6	0.683	37.5	37.0
	9	0.00125	38.9	39.4
	10.8	0.648	36.3	38.9
Ammonium Hydroxide	9	0.00261 (% NH_3)	...	39.6
	12	5.8 (% NH_3)	...	22.9
Sodium Hydroxide	8	0.000044	38.9	39.7
	9	0.00023	38.9	39.5
	12	0.46	37.9	18.7
Ethylene Diamine	8	0.00052	39.2	39.0
	9	0.0009	38.8	39.2
	12	5.37	37.3	15.0
Triethanolamine (Coml.)	8	0.00563	39.3	39.5
	9	0.87	39.4	38.8
	12	65.2	37.6	37.6



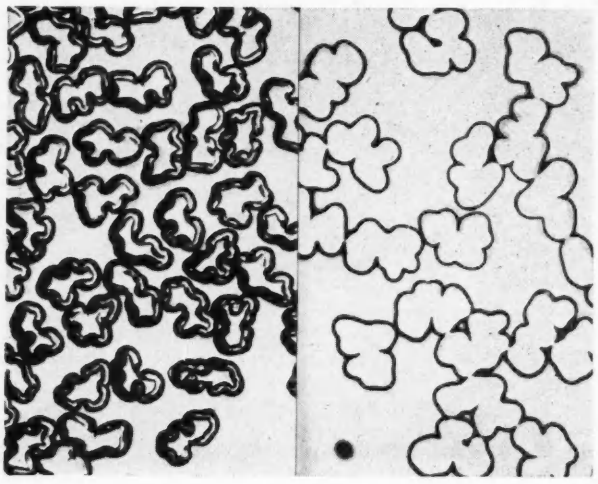


Fig. 8

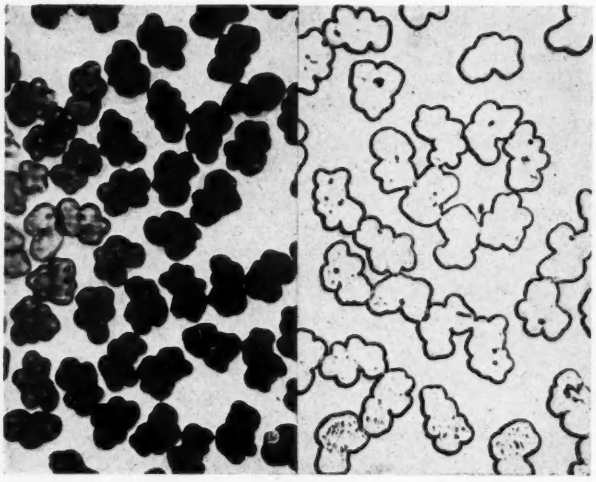


Fig. 9

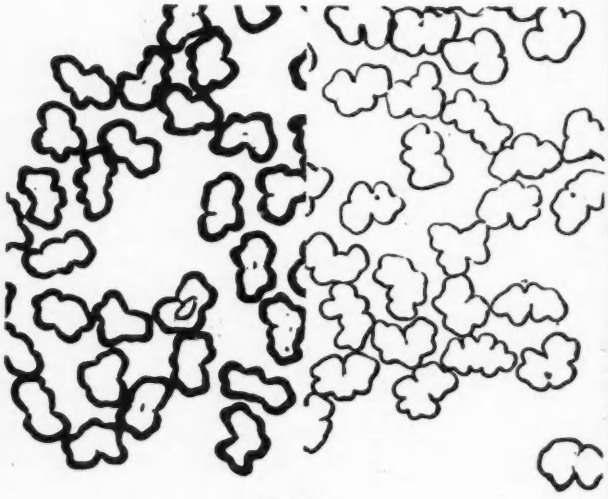


Fig. 10

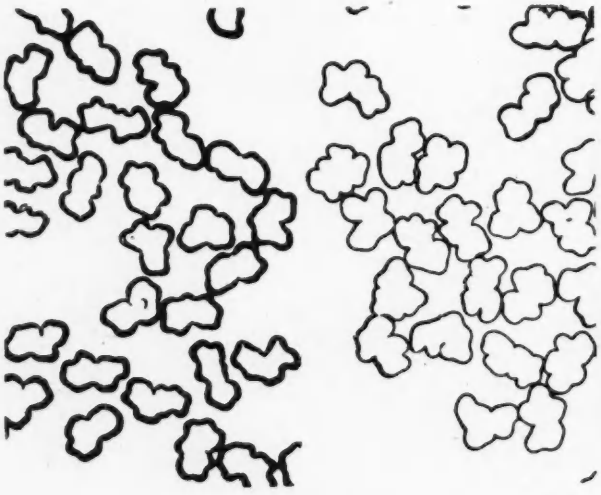


Fig. 11

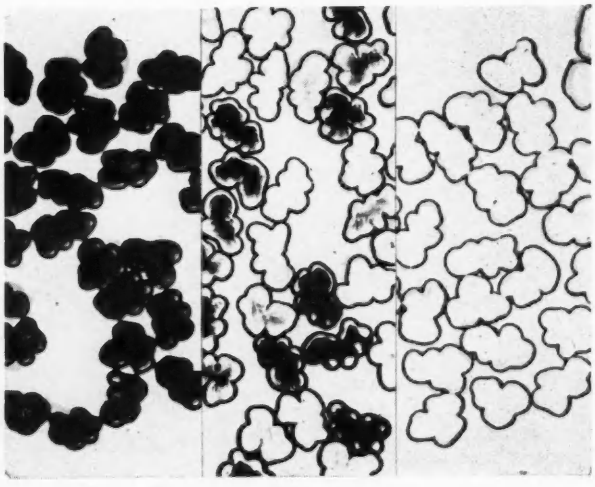
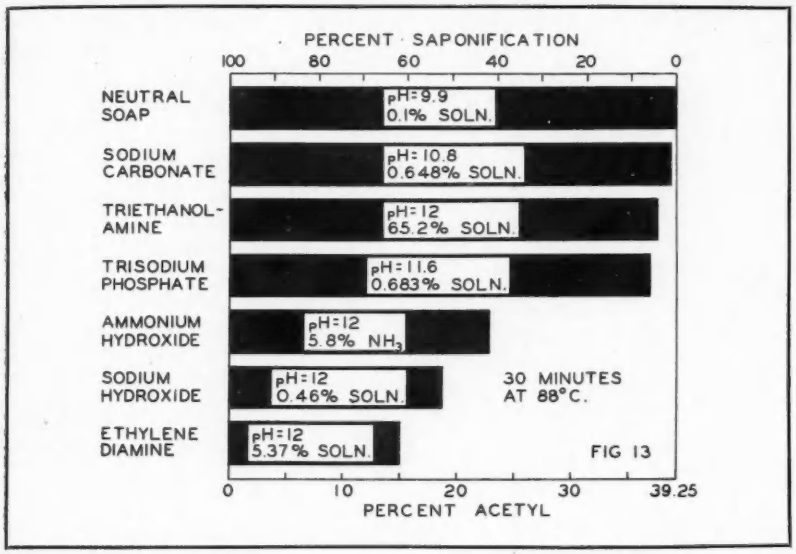


Fig. 12



alkali, the time and temperature and physical state of the material to be saponified, i.e., twist, construction, etc.

The photomicrographs in Figure 8 show that saponification by sodium hydroxide is a surface phenomenon. The technique used to prepare these cross-sections for study was to dye the yarn after exposure to the saponifying agent in a 5% solution of Viscose Blue BB. After drying, the slides were prepared in the usual manner. The outer sapoified layer will not be visible unless the sections are sliced quite thin, i.e., ten to twelve microns. The section with the heavy black outline was treated with caustic soda at a pH of 12 for thirty minutes at 88°C., while the other section was treated at a pH of 9 under the same conditions of time and temperature. Figure 9 shows the completely diffuse nature of the saponification with ethylene diamine. The denser of the two sections was treated at a pH of 12 for thirty minutes, at 88°C. while the less dense one was treated at a pH of 12, and a temperature of 88°C, but only for five mintues. Note, however, that at only five minutes some saponification on the interior of the fiber is already evident. Figure 10 illustrates the effect of triethanolamine. Both specimens were treated with a solution of the base at 88°C. and a pH of 12. After ten minutes there was no appreciable effect, while at thirty minutes time there is a very pronounced surface effect.

Figure 11 shows the effect of trisodium phosphate at a pH of 11.5 and times of five minutes and thirty minutes at 88°C. It is obvious that here also appreciable surface change has taken place.

The action of ammonium hydroxide on cellulose acetate is interesting in that no saponification is obtained at 88°C. when heated at atmospheric pressure. However, if the specimens of yarn are sealed in glass tubes and heated, appreciable saponification does take place and it is of the diffuse type as shown in Figure 12. It is interesting to note the progress of the reaction. At five minutes time only slight saponification has taken place. At ten minutes exposure time the acetyl value has dropped from 39% to 28% and after thirty minutes to about 23%. Note that this is a diffuse saponification and the dyeing by a direct color takes place first on the inside of the fiber.

Conclusions

The studies described in this paper have demonstrated that the saponification of cellulose acetate by caustic soda can be accurately controlled if proper attention is given to the factors of time, concentration of alkali, and the temperature of the reaction bath. It has also been shown that a number of alkalies can be used and that the resultant saponification depends on the nature of the alkali and not on the pH of the solution. Agents which give a preponderance of surface saponification are caustic soda, soda ash, trisodium phosphate, triethanolamine. On the other hand, ammonia under pressure, and ethylene diamine give a diffuse type of saponification. It is believed that saponification by these and other agents can be controlled to any desired degree by the proper attention to time, concentration, temperature, and the nature of the saponifying agent. It is to be emphasized that anyone applying these data to commercial finishing must also consider the physical state of the material, such as, tension, twist, construction, etc.

Acknowledgement

The author wishes to acknowledge the assistance of H. G. Scull, of the A. M. Tenney Associates, Inc., and H. G. Reed, M. A. Urquiza, and S. H. Hubbard, of the Tennessee Eastman Corporation, in collecting the data given in this report.

—♦ ♦—

Wool Dyeing—

(Continued from Page 63)

The excessive crocking of fabrics made from continuous dyed indigo raw stock was greatly reduced by a careful washing after fulling with subsequent washing in the neutralizing process and a run through the Derby dry cleaning machine after shearing *(12)*.

Excessive crocking of certain chrome colors and especially Picramic Brown B C.I. 101 is often experienced if the dye is not properly dissolved at the start of the dyeing operation. An addition of ammonia to the dissolving solution will prevent Picramic Brown B from crocking. However, when ammonia is not used, some of the undissolved dye is exhausted onto the outer parts of the fibers and crocking results. As an example, when browns which show excessive crocking are woven with white wool and fulled, the brown bleeds off and stains the white. This is easily explained by the fact that rinsing in plain water after dyeing will not remove the water insoluble dye from the surface of the fibers. However, the dye is readily soluble in soaps and alkalies and is immediately dissolved from the fibers when immersed in such solutions from which staining of the white results.

Acid sensitive and other unlevel dyeing types have considerable affinity for the wool fiber and exhaust rapidly from strongly acid baths. When this occurs, the dye may be precipitated on the materials, causing surface dyeing and in extreme cases bronziness and consequently a reduction in the normal fastness to crocking occurs. Acid sensitive dyes should be applied from a dye bath with the pH adjusted near the neutral point. Free acid should be replaced with ammonium acetate or sulfate at the start of the dyeing operation. When the dye bath is exhausted a feed of well diluted acetic acid can be made without danger of causing unevenness or poor crocking.

The constitution of the dyes used and the way in which they combine with the fiber also determines to some extent the degree of fastness obtained. Greater care is necessary when fibers such as mohair, alpaca, camel hair, and vicuna are dyed because they have a greater tendency to crock than wool dyed with the same colors.

Unscoured animal fibers which contain natural or spinning oils also crock excessively when dyed. Dry cleaning such materials greatly reduces or eliminates the crock and demonstrates that clean material is important insurance against excessive crocking.

The authors wish to acknowledge the help received from Miss Grace Kentos and Thomas Scanlon for the preparation of the dyeings and crock tests; to their associates F. W. Fordemwald and C. A. Amick for their help in reviewing the manuscript; also to thank C. Maresh and Miss Florence Gustafson of the Microscopical Laboratory for their cooperation. The electron micrographs which are shown were prepared for this paper by the Physics Department of the Stamford Research Laboratories of the American Cyanamid Co.

Photomicrographs for this paper were made in the laboratories of Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J., who also furnished the color plates of these photomicrographs.

—♦ ♦—

Meeting, N. N. E. Section

THE first meeting of the 1947 season of the N.N.E. Section was held Friday, Jan. 17, at the Hotel Manger, Boston, Mass. Following dinner, in the absence of Chairman George O. Linberg, Vice-Chairman Frank J. O'Neil presided. He welcomed the 75 members and guests present and called on Delbert E. Ray, Edward S. Chapin, and Walter J. Hamburger to speak on highlights of the recent Silver Jubilee Convention. Harold C. Whiting of the A. C. Lawrence Leather Co., Peabody, Mass., spoke on "Industrial and Apparel Leathers." This interesting paper was animated by an extensive display of skins and finished leather products. A lively question and answer period followed.

HERBERT E. WIELAND,
Publicity Chairman

—♦ ♦—

Meeting, Philadelphia Section

THE Philadelphia Section meeting was held on Friday, January 17, 1947, in the North Roof Garden at the Bellevue-Stratford Hotel.

Curt Baeringer, 1946 Chairman, thanked M. H. Klein and program committee, Maurice Guertin and membership committee, and Thomas Hart who had charge of the prizes for the Annual Outing, for their efforts in making 1946 a successful year in the AATCC. The meeting was then turned over to the new chairman, Walter F. Fancourt, III.

The speaker of the evening, P. J. Wood, was then introduced. His subject was "Enzymes in the Treatment of Textiles." Mr. Wood answered numerous questions from the audience.

There were 128 present for dinner and 150 for the meeting.

Respectfully submitted,
A. E. RAIMO,
Secretary

—♦ ♦—

Meeting, North Carolina Student Chapter

ON Wednesday, January 15, the Student Chapter of North Carolina State College listened to a lecture by N. M. Agnew, Field Engineer of the International Salt Company of Scranton, Penn. The speaker had for the title of his lecture "The Lixate Process for Making Salt Brine."

He gave statistics on salt mining, and stated that the deposit in Louisiana was tremendous. This mine's product is rock salt of a fine natural purity. Comparisons were made between mined salt and evaporation salt; the latter being used for some purposes, and the mined salt for others. The rock salt finds more use in the textile industry, being used in great quantities in the application of dyestuffs to many of the textile fibers.

With the aid of blackboard sketches, the speaker explained the principle of Lixate method of making and using brine. Just for the meeting, Mr. Agnew installed a working model of the Lixate equipment in the large dyeing lab of the Textile school. Some of the brine solution made in this equipment was tested in front of the students by use of a special hydrometer which reads in percentage of fully saturated solution of salt. This saturation amounts to about two and sixty-five hundreth pounds of salt per gallon. This instrument is called a "Salometer."

The lecturer continued with a discussion of practical application of the method in many mills where the costs had been compared with the costs of dry salt in the same dyeing processes. The claim is made that more even dyeing results by use of this method as well as a saving in cost with the use of smaller quantity of salt.

The lecture was followed by a question and answer period.

Officers of the Student Chapter at N. C. State are Horace Penn, President; Elizabeth Frazier, Secretary and Prof. A. H. Grimshaw as Advisor.

Respectfully submitted,
ELIZABETH FRAZIER,
Secretary

CALENDAR OF COMING EVENTS

EXECUTIVE COMMITTEE ON RESEARCH
Meeting: February 18. (Bellevue - Stratford Hotel, Philadelphia)
Meeting: March 20.

MID-WEST SECTION
Meeting: February 22. (Bismarck Hotel, Chicago, Ill.)

NEW YORK SECTION
Meetings: March 7, May 2. (Swiss Chalet, Rochelle Park, N. J.)

RHODE ISLAND SECTION
Meeting: February 28. (Johnson's Grill, Providence)
Meetings: March 28, April 25.

PHILADELPHIA SECTION
Meetings: February 28, April 11, May 23.

NORTHERN NEW ENGLAND SECTION
Meetings: March 21, April 11, May 16, September 26, November 21.
Outing: June 13.

PIEDMONT SECTION
Meeting: April 12. (O. Henry Hotel, Greensboro, N. C.)
Outing: June 20 and 21. (Ocean Forest Hotel, Myrtle Beach.)

RESEARCH COMMITTEE
Sub-Committee Meeting: March 20. (Hotel Pennsylvania, New York.)
Meeting: March 21. (Hotel Pennsylvania, New York.)

COUNCIL
Meeting: March 21. (Hotel Pennsylvania, New York.)

NATIONAL CONVENTION
October 23, 24, 25. (Congress Hotel, Chicago, Ill.)

EMPLOYMENT REGISTER

This column is open for four insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association, Lowell Textile Institute, Lowell, Mass. It is understood that these will be open to inspection by prospective employers, who can obtain further information through the code numbers from the Secretary.

47-23

Education: High school and part college.
Experience: 17 years, mainly with one company, application laboratory work on variety of dyes and fibers, including printing and resin bonded pigments, with executive responsibilities.
Age 36; married; references; will go anywhere in U. S.

47-24

Education: High school, and courses in R. I. School of Design.
Experience: Boss dyer, wool raw stock, cotton.
Age 50; widower; references from all employers; will go anywhere in U. S.

TRADE NOTES • NEW PRODUCTS

• Philip J. Lo Bue Co.

Philip J. Lo Bue, for the past six years director of the Chemical Sales Division, Michigan Chemical Company, resigned this month to form his own company for the manufacture of iron reduced by hydrogen, iron phosphate (white insoluble powder), and for the sale of bromine, bromides, fine chemicals and biologicals.

The new organization, which has offices at 70 East 45th Street, New York City, Room 5939, will be known as Philip J. Lo Bue Company, Chemicals, Telephone Murray Hill 5-4611, 4612.

Philip J. Lo Bue

Mr. Lo Bue, who is a past president of the Salesmen's Association of the American Chemical Industry, a member of the Chemists' Club and the Drug & Chemical Club, was with J. T. Baker Chemical Company for nine years as New York office manager. Previous to that he was associated with Merck & Co. for 13 years as a member of the sales department.

The new company is exclusive sales agent for D & L Chemical Products Company. Other fine chemicals and biologicals will be added to the company line shortly, Mr. Lo Bue announced.

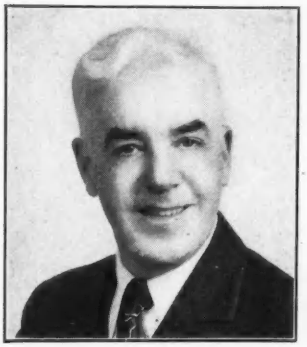
• Vinylite Resin Nylon Finish

AHCO 1250, a new vinylite resin finish for nylon hosiery, has been developed by Arnold, Hoffman & Co., Providence, R. I. This new resin emulsion can be applied easily with standard finish equipment, and in the same manner as ordinary finishes, it is stated.

When used in recommended proportions, AHCO 1250 imparts increased snag-resistance and an improved appearance, it is stated by the firm. Dullness is accomplished as required, and a superior hand obtained. The use of Ahcovels E, F or R as softeners is suggested by the firm for greater resiliency and finer texture, since these softeners are all compatible with AHCO 1250.

According to Arnold, Hoffman & Co., there is no toxicity or inflammability risk incurred by the use of AHCO 1250; it is long-lasting and will not wash off during the average life of nylon hose; and use of this finishing resin effects an appreciable reduction in irregulars due to handling.

• Joins Burkhart-Schier



Wallace C. McElroy, who has joined Burkart-Schier Chemical Company, Chattanooga, Tennessee, as technical and sales representative in the New England area, with headquarters at Lowell, Massachusetts. Mr. Mc Elroy is a native of Massachusetts and has had many years experience in the application of textile wet-processing agents.

Burkart-Schier Chemical Company operates plants at Chattanooga, Knoxville and Nashville, Tennessee.

• Award to Leeds & Northrup

Leeds & Northrup Company, makers of electrical instruments and heat treating furnaces, was given the first annual Industrial Relations Award of the Philadelphia Chamber of Commerce and Board of Trade at a dinner at the Bellevue-Stratford on January 15.

The award, a silver plaque, was made by William L. Batt, president of SKF Industries, to Charles S. Redding, president of Leeds & Northrup.

The presentation was made at the close of the first annual two-day Industrial Relations and Production Conference sponsored by the Chamber of Commerce and Board of Trade, its Industrial Relations Council and cooperating organizations.

"It is because the Leeds & Northrup Company has developed and maintained for the nearly 50 years of its existence one of this country's best industrial relations programs," Clement V. Conole, general manager of the Chamber, said, "that we have chosen them to be the recipient of our first award."

It was revealed that the award committee's attention was drawn to Leeds & Northrup by a party which the company gave in Convention Hall on November 16, when more than 2,000 employees sat down to a five-course turkey dinner and listened to Mr. Redding give a detailed recital of the firm's finances for the last fiscal year, including distribution of profits.

This event, widely hailed as a unique demonstration of industrial democracy, resulted in many inquiries from executives interested in improving industrial relations in their own organizations.

• Printing With Pigment Colors

Printing with Pigment Colors is described in the newly-revised Bulletin P-1, "Printing With Aridye Pigment Colors—400 Series," just issued by Interchemical Corporation — Textile Colors Division, P.O. Box 357, Fair Lawn, N. J. Included in this bulletin is information on the advantages of Aridye pigment colors, preparation of printing emulsions, properties of solvents, storage and handling of colors and clears, printing procedures, drying and curing, fastness properties, and other details on printing with pigmented emulsions of the water-in-oil type.

• Powell Made Superintendent

H. H. Burton, President of Lonsdale Company, Providence, R. I., to-day announced the appointment of Richard W. Powell, as Superintendent of Lincoln Bleachery & Dye Works Division.

Mr. Powell received his technical education at the College of Technology, Manchester, England. After receiving a prac-

tical mill training in the bleaching, dyeing, printing and finishing branches of the industry in England, he accepted a position with the Dominion Textile Company of Montreal, Canada, where he was employed for nine years successively as chief chemist, superintendent of dyeing, and assistant plant superintendent.

Since 1939 he has been with Bradford Dyeing Association, (U.S.A.), Bradford, R.I., in the capacity of Director of Research and Development.

Mr. Powell assumed his new duties at the Lincoln Bleachery & Dye Works on February 1st, filling the vacancy made when Ralph Carlson, formerly superintendent, was promoted to Manager.

• Phi Psi Plans Underway

Plans for the national convention of Phi Psi Textile Fraternity at the Hotel Charlotte, Charlotte, N. C. May 2-4 are being made by the Charlotte Alumni Chapter. A. R. Thompson, Ciba Company, Inc., Charlotte, N. C., will be Master of Ceremonies, and efforts are being made to secure a prominent speaker for the occasion. Information pertaining to the convention may be secured from J. V. Killheffer of E. I. DuPont de Nemours & Company, Charlotte, N. C.

• Leeds & Northrup Catalog

To provide information about a pyrometer which supplements the well-known Micromax line of instruments for those applications which require split-second response to temperature changes, or unusually rapid concentration on a single chart of data from many points, Leeds & Northrup Company has just issued an illustrated 16-page catalog, "Speedomax Type G Pyrometers."

The instrument described in this publication is available for use with thermocouples or Rayotubes, is either a single-point or a multiple-point recorder and can be supplied to operate virtually any of the full line of L&N signals and controls.

Illustrations in the catalog show the construction of balancing motor, slide-wire, and vacuum-tube amplifier unit. A schematic diagram illustrates the essentials of this balance-type instrument. There is also a full-size reproduction of strip-chart, showing several of the types of records which these instruments can provide; a single-point continuous-line record, or a multiple-point record of from one to as many as sixteen temperatures, in one color or as many as six.

Anyone who desires a copy of this publication may have it by writing to the Leeds & Northrup Company, 4934 Stenton Avenue, Philadelphia 44, Penna., and asking for Catalog ND46(1).

• Research Director Emkay

H. Martin Friedman, who has been appointed Research Director in charge of the development and application of new synthetic chemicals for the Textile Division of Emkay Chemical Company, Elizabeth, N. J., Manufacturers of Synthetic Detergents, Textile and Leather Chemical Specialties. Mr. Friedman received his Master's Degree in Chemistry from the Graduate School of New York University and was formerly Chief Chemist of the Leather Chemicals Division, Hart Products Corporation, N. Y. City and was Plant Manager of DePaul Chemical Company, Long Island City before joining Emkay Chemical Company.

• New Bedford Alumni Dinner

Harold Sturtevant, 44 Brookside Drive, Cranston, Rhode Island, Vice-president of the New Bedford Textile Institute Alumni Association, announces a dinner on Saturday, March 1, 1947.

This dinner will be held at the Narragansett Hotel, Providence, at seven P.M. During the war these dinners were suspended, but from present enthusiasm for such a gathering, indications are that this affair will be largely attended.

The New York section will be represented by Pres. W. F. Macia of the New York Alumni Group, who is with A. M. Tenny Assoc., 10 East Fortieth St., New York City. The New Bedford section will be led by Francis Tripp, Treasurer of the Alumni Association, who is Professor of Chemistry and Dyeing at the N.B.T.I. The Boston delegates will be led by Russell Carroll, 80 Federal St., Boston, accompanied by John H. Grady, President of the N.B.T.I. Alumni Assoc., and N. V. (Swede) Nelson, famous leader of sports and a Trustee of N.B.T.I.

All graduates of N.B.T.I. will be welcome. Contact any of the above members.

• Sharples Continental Corp.

Sharples Continental Corporation is a new company, formed and entirely owned by Sharples Chemicals, Inc. and the Continental Oil Company. This company will function as a manufacturing organization for production of synthetic organic chemicals from petroleum raw materials.

Top executives of the new corporation are Mr. Paul Kendall, Executive Vice President of Sharples Chemicals, Inc. and Mr. Harold Osborne, Vice President of Continental Oil Company. Both men will retain their respective positions with the parent companies.

The first production unit will be located in Baltimore, Md., at the site of a former Continental Oil Company refinery. This plant will manufacture nonylnaphthalene, an alkylated aryl hydrocarbon, which serves as a raw material for the production of a wetting, washing and emulsifying agent of the alkyl-aryl sulfonate type. This hydrocarbon will be marketed by Sharples Chemicals, Inc. under the tradename "Neolene."

Formation of this new company will bring together the resources and facilities of the Continental Oil Company, one of the major producers, manufacturers and marketers of Petroleum products and Sharples Chemicals, Inc., who have been pioneers in the synthesis of organic chemicals from petroleum and other sources.

Offices will be maintained at Baltimore, Md., 123 South Broad Street, Philadelphia, Pa., and Ponca City, Oklahoma.

• Organic Nitrogen Compounds

"Organic Nitrogen Compounds" is a new 31-page booklet recently published by Carbide and Carbon Chemicals Corporation, a Unit of Union Carbide and Carbon Corporation. This booklet presents in detail the properties, specifications, and uses of the alkyl amines, alkylene amines, alkanolamines, and acetoacetarylamides. In chart form it gives their physical constants, comparative hygroscopicities, and neutralization curves. These compounds are used by various industries for many purposes such as emulsifying, neutralizing, synthesizing, dissolving, and saponifying.

The organic nitrogen compounds are extremely reactive; with acids they form salts or soaps; with esters, anhydrides, and

acyl halides they form substituted amides; and with ketones, aldehydes, and alkyl halides they form other important derivatives. Many of the present applications of amines arise from their ability to neutralize acidic materials, such as in aqueous systems as corrosion inhibitors; in purification of gases by the removal or concentration of hydrogen sulfide or carbon dioxide; and in the formation of emulsifiers for polishes, cosmetics, insecticides, water paints, and cutting oils. They are widely used as intermediates in the production of dyestuffs, detergents, textile softeners, cement setting compounds, photographic and rubber processing compounds, anti-malarials, local anesthetics, and pharmaceuticals. Newer uses for amines include ion-exchange and water-softening resins, germicides, flotation agents, petroleum emulsion breakers, gasoline additives, and catalysts.

Copies of this new booklet may be obtained from any Office of Carbide and Carbon Chemicals Corporation. When requesting your copy ask for Form 4770.

• Calco Hosiery Bulletin

The Calco Chemical Division, American Cyanamid Company, Bound Brook, New Jersey, announces the release of their new Calco Technical Bulletin No. 783, "The Dyeing and Lanaset* Resin Treating of Wool Hosiery." This paper was prepared by H. E. Millson, assistant manager of the Calco Application Laboratories, for the November 1946 issue of the Hosiery and Underwear Review, to provide the dyer answers to some new problems created by Lanaset Resin treated wool hosiery.

Mr. Millson points out that these problems are readily corrected by the careful selection of dyes and that experiments have shown that it is preferable to dye the hosiery before applying the resin. He also names three classes of dyes which may be used for dyeing wool hosiery successfully.

A copy of Calco Technical Bulletin No. 783 may be obtained through your Calco representative or by writing the Advertising Department, Calco Chemical Division, American Cyanamid Company, Bound Brook, New Jersey.

* Registered U. S. Patent Office.

• New Forced Draft Dryer

A firm of industrial physicists, Baird Associates, University Road, Cambridge 38, Massachusetts, has announced the development of a new type fiber dryer for moisture determinations. Unlike conventional "oven type" dryers, heated, filtered air is forced through the sample under test. It is claimed that moisture is removed in a matter of minutes instead of hours even when the sample contains 60 per cent moisture and is as large as 400 grams.

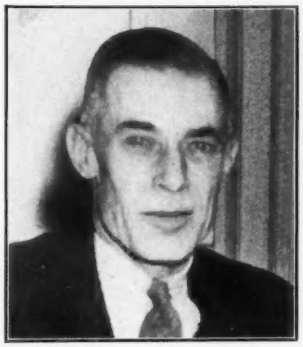
Temperature is controlled to 2°C. and may be set anywhere within a range of 80°C. to 240°C. Four individual drying chambers permit simultaneous drying of four samples, or eight samples if double containers are used. Rotary pumps force 13 cubic feet of air per minute through the specimen being dried. A vent at the top of the apparatus exhausts the moisture laden air.

Forced Draft Dryer

Any good laboratory scale measuring to 1/10 of a gram is satisfactory for weighing the wool before and after drying. Aluminum containers with perforated bases for holding the samples are supplied with the unit. Containers are available in 5¼" high and 10½" high sizes. Covers are provided for capping both ends of the container if the laboratory wishes to allow the wool to cool before final weighing.

The apparatus is a completely self-contained unit and is made to operate on 220 V. AC 60 cycle, 3 phase current. Additional details are available from the manufacturer. Ask for Bulletin No. XXIV.

• Export Manager, Calco



Fraser M. Moffat, Jr., whose appointment as manager of the Export Department of the Calco Chemical Division, American Cyanamid Company, has been announced by S. C. Moody, Vice President and General Manager.

Mr. Moffat, since 1934 a vice president of U. S. Industrial Chemicals, Inc., in charge of development of new products, served during World War II with the rank of Colonel, Chemical Warfare Service. He is a graduate of Williams College, Class of '18, A.B. He later attended Massachusetts Institute of Technology where he received his B.S. degree in Chemical Engineering in 1920. He was associated until 1931 with the National Aniline & Chemical Company as production manager and later as director of manufacturing. From 1931 to 1936 he was president and a director of Earl, Moffat & Co., Inc. Mr. Moffat served in World War I as a 2nd Lieutenant, Infantry U. S. Army. He was recalled to active duty in the army July 1942, after serving nine months with the War Production Board as Chief of the Alcohols and Solvents Section, Chemicals Division.

Mr. Moffat will make his headquarters at the Bound Brook Plant of the Calco Chemical Division, American Cyanamid Company. His department will handle all export sales for the company of dyestuffs, intermediates and pigments.

• Joins Apex Chemicals

Apex Chemical Co., Inc., New York City, announces the appointment of Robert Zeuren to the sales staff in the New England territory. Mr. Zeuren, until recently, was superintendent of dyeing and finishing for the International Processing Co., Elizabeth, N. J., and has a background of 25 years of actual experience.

• New Cationic Active Softeners

Four products suitable for softening cottons and rayons are the latest additions to the line of textile chemical products of the Textile Chemical Division of the Dexter Chemical Corporation of New York City. It is claimed that these

products—"Softol AC, AD, XAC and XAD"—are especially satisfactory for softening cottons and rayon fabrics which have been finished with cellulose products such as Kopan, Celfon and Ceglin.

All four "Softols" are soluble in water and said to be unaffected by hard water and to exhaust on to the fabric readily. It is stated that only small amounts are necessary to give a full degree of softening —one-quarter to one-half percent on the weight of the gods will be found sufficient. "Softols" are compatible with starch, dextrine, gums and many other finishing agents but, being cationic, should not be used with soaps, sulfated oils or any anionic active agent.

"Softols" are soluble in neutral, acid or alkali solutions but sulfates tend to affect their solubility.

It is stated that, while all cation active softeners have a tendency to change the shade of some direct colors, the "Softols" are adjusted to have a minimum effect and they have a preventative effect on the gas-fading of acetate colors.

"Softol AD" and "Softol XAD" are recommended where a soft but full hand is desired. The "AC" and "XAC" give a soft and thin hand.

"AC" and "XAC" are recommended by the Dexter Chemical Corporation, where maximum anti-fume properties as well as high-softening are desired on acetate colors.

• Chicago Office, Heyden Chemical

On January 1 the Chicago branch of Heyden Chemical Corporation occupied more spacious offices at 20 North Wacker Drive. The new address is that of the Civic Opera Building between Madison and Washington Streets on Wacker Drive. It is very conventiently located at the West side of the "loop" proper near the La Salle, Northwestern and Union Railway Stations.

F. A. Degener is in charge of the Heyden Chicago office. Representatives are J. E. McDonnell, William C. Ellis and G. S. Kahle.

Invitations are cordially extended to the trade to visit the new Chicago office of Heyden.

• Stainless Steel Poteye

The new Rodney Hunt Poteye is made of 18-8 stainless steel, with a smooth, satin-like finish, and, it is claimed, is positively unbreakable.

It is stated that, once put in use it will probably never need replacing. Its first cost is higher than conventional porcelain or phenolite poteyes, but due to the indestructibility of this new Rodney Hunt Stainless Steel Poteye, the first cost is said to be the last cost.

Further details are available from hte Rodney Hunt Machine Company, Orange, Massachusetts.

• Research Director, American Dyewood Company

Dr. W. S. Peck who has recently been appointed Director of Research of the American Dyewood Company. He will make his headquarters at the Research Laboratory located at Belleville, New Jersey.

Dr. Peck is a graduate of the University of British Columbia, Vancouver, B. C., having received his B. S. degree in 1922 and his M. S. in 1925. He received his Ph. D. from the University of Pittsburgh in 1927. After leaving the University of Pittsburgh, Dr. Peck was associated with E. I. DuPont de Nemours & Company.

Dr. Peck came to the American Dyewood Company in 1930, starting in at the Chester, Pa. factory, where he was engaged in both Production and the Research Department. Dr. Peck's activities cover the entire range of products produced by the American Dyewood Company, such as Dyewood Extracts, Tanning Extracts, Printing Inks and Synthetic Dyestuffs, manufactured for the textile, leather and paper industries.

• Board of Trade Officers

H. L. Brooks was elected President of the New York Board of Trade to succeed Ralph E. Dorland, an Executive of the Dow Chemical Company, who becomes Chairman of the Board.

Floyd W. Jefferson, President, Iselin-Jefferson Company, Herbert W. Schaefer, President, H. W. Schaefer & Company, Warren L. Baker, Manager, Aviation Division, Socony-Vacuum Oil Company, were elected Vice-Presidents.

Harry J. Carpenter, Guaranty Trust Company of New York, was reelected Treasurer. M. Leo Gitelson, President, Nehemiah Gitelson & Sons, was reelected Assistant Treasurer.

Richard Kulze was reelected to the office of Secretary.

Edwin M. Otterbourg was reelected General Counsel, and M. D. Griffith was reelected Executive Vice-President.

The election was held at a special meeting of the Board of Directors at the Hotel Astor on Thursday, December 19th, 1946.

• Hooker Retirement Program

The Hooker Electrochemical Company has inaugurated an employee's contributory retirement program, effective as of October 1, 1946. The program provides for retirement income for life based on both past and future service. The cost of benefits based on future service is defrayed by contributions of both the employees and the Company, the Company paying about four-fifths of the total cost. In addition the Company will bear the entire cost of past service benefits to which long service employees would have contributed had the program been in effect since the Company was founded 40 years ago.

The program is designed to provide benefits which together with Social Security benefits will approximate 50 per cent of the average earnings for employees who retire at their normal retirement date after 25 or 30 years of service.

E. R. Bartlett, president of the Company, in announcing the program to employees, stated that both management and employee groups have for many years been interested in establishing the proper type of retirement program. In offering this program, Hooker management is fulfilling a long standing desire which constitutes another milestone in the already pleasant relation between employees and the Company. The ready acceptance and pleasure of Hooker employees in both Tacoma, Washington and Niagara Falls, New York plants is evidenced by over 97 per cent of eligible employees having applied for membership.

The Company's group insurance and sickness and disability benefit plans will be continued along with the pension program.

SANDOZ PRESENTS *The color achievement of the month*

Translation From The Oriental BY KARASTAN

Here, power-loomed in the United States, is a rug that captures the world-famous beauty of a handwoven Oriental. Karastan, a product of Fieldcrest Mills, Leaksville, North Carolina, faithfully preserves the soft and lustrous colors of the original to give the American home a floor covering that would delight an Eastern potentate... at a price that meets the average American budget.

To be sure of colors that, first, are authentic and, second, can be depended on to resist the effects of time and wear, Karastan counts, among its suppliers, Sandoz—the firm that so many look to for colors that are timely—and timeless.

Prominent among Sandoz colors fulfilling the requirements of both the manufacturer and the consumer is the Brilliant Alizarine Milling Blue BL, joined recently by the new Brilliant Alizarine Milling Blue 2RL (pat. app. for), a rich royal blue shade. Both these blues have "men's wear" fastness without the need of chrome. Other colors in this same group are Brilliant Alizarine Milling Blue G and SL, Alizarine Light Brown BL, and Brilliant Alizarine Light Violet FFR.

For acid, chrome or direct dyes... or auxiliary chemicals... for both natural and synthetic fibres... be guided by the successful "color achievements" you have been seeing in these Sandoz advertisements. Sandoz application laboratories are located in New York, Boston, Philadelphia, Los Angeles, Charlotte, Toronto, where stocks in wide range are carried.

Other branches are in Chicago, Paterson and Providence.

SANDOZ CHEMICAL WORKS, INC., 61 VAN DAM STREET, NEW YORK 13, N. Y.

SANDOZ *thinks ahead with textiles*

S SANDOZ

ENGRAVERS OF

Textile and Plastic Printing Rolls

Economies in color used—and efficient application of the design to the textile or plastic being printed are indicated by the past experience of users of Linotone engraved rolls.

Send us details of your problem and let us see if we can help you.

LINOTONE CORPORATION

559 W. 35th Street, New York 1, N. Y.

QUALITY RICHMOND PRODUCTS

Less Handling with

AFTER CHLOR

Eliminates 3 to 5 Handlings

Bleach with
Hypochlorite
Rinse and Use

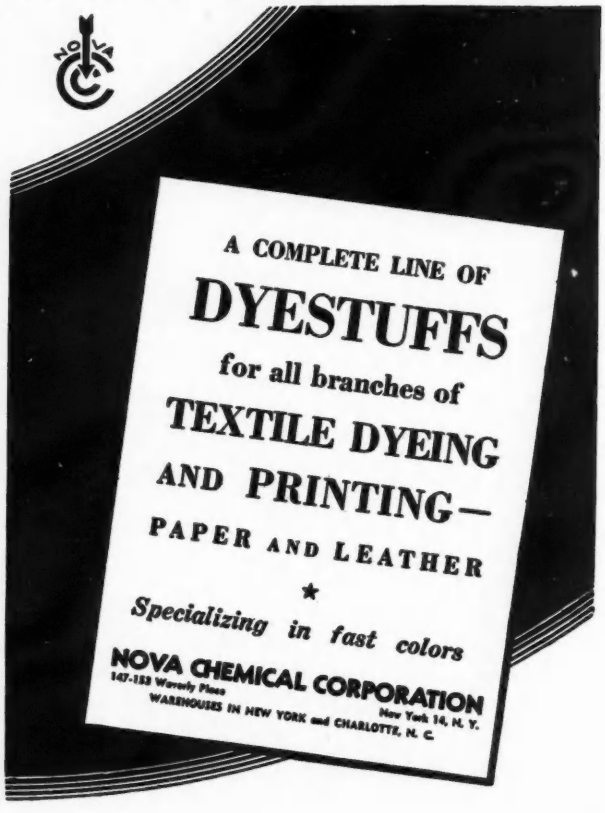
AFTER CHLOR

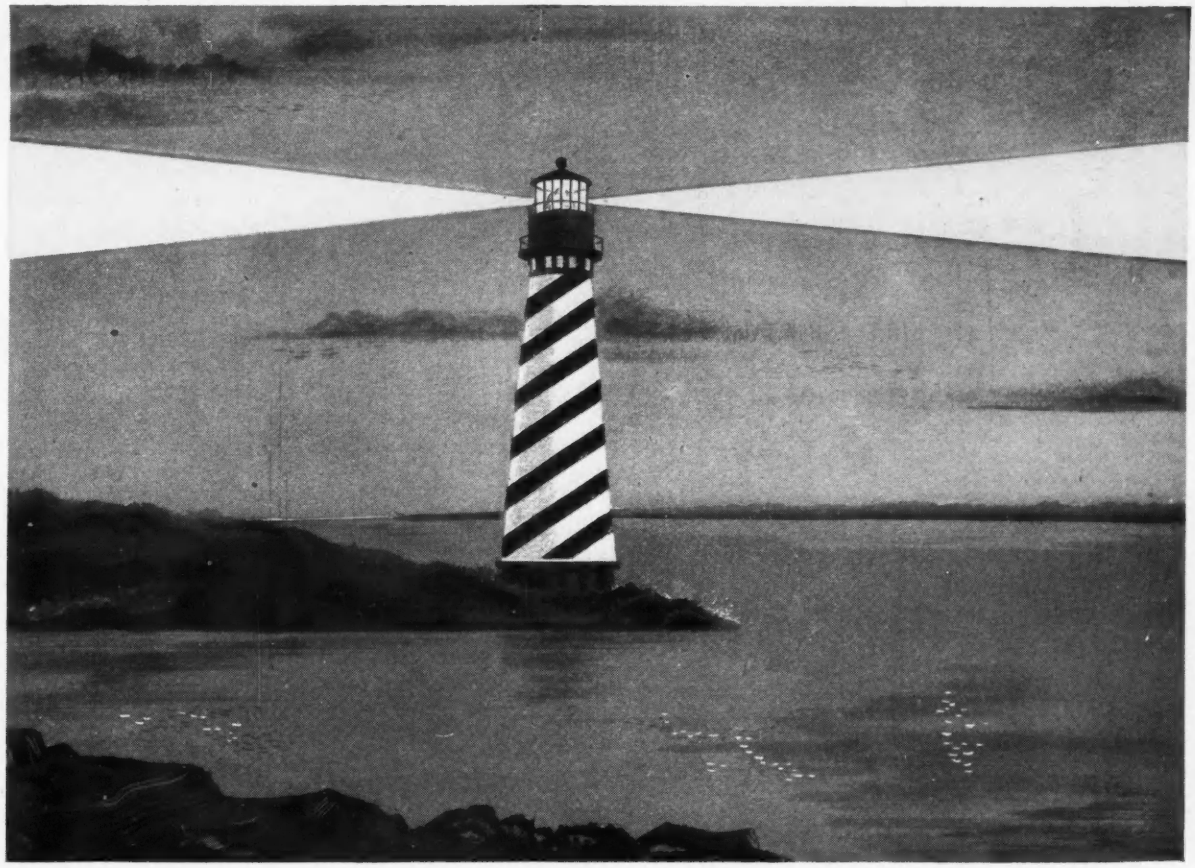
THAT'S ALL!

Write for FREE Sample

RICHMOND OIL, SOAP & CHEMICAL CO., Inc.

1041-43 FRANKFORD AVE., PHILADELPHIA 25, PA.





It keeps you out of trouble

DIASTAFOR de-sizing agents give you a wider margin of safety

The mariner depends on the light in the beacon tower to keep him out of trouble. It gives him a margin of safety beyond compass and chart.

Many bleachers and dyers have found that they, too, need a margin of safety; they find it in Diastafor brand de-sizing agents, which keep them out of trouble when they have difficult jobs to do.

Diastafor de-sizing agents are your assurance of easy, economical, trouble-free operation. The fact that they can be used in a wide range of temperatures and pH appeals to those who have to deal with unknown factors. "Problem lots" can be eliminated when you use Diastafor.

Diastafor de-sizing agents come in various types—among them you will find one to meet any need. Whichever type you choose, you will find it will give you superb performance every step of the way. Yard after yard, you will get the fine "hand" you look for in your finished goods. Try Diastafor for cottons, rayons, mixed goods — the results will be uniformly good.

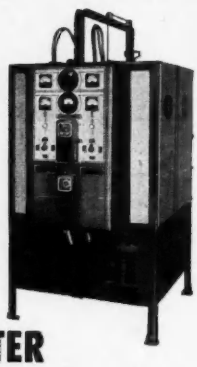
Our sales and technical staffs will be glad to furnish further information regarding Diastafor brand de-sizing agents. A trial will show you why Diastafor has been the leader for 39 years. Write Strong Cobb Division of STANDARD BRANDS INCORPORATED, *Diastafor Department*, 595 Madison Avenue, New York 22, New York.

DIASTAFOR

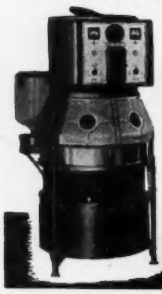
A TRADE MARK OF STANDARD BRANDS INCORPORATED

TEST TEXTILES for WEATHERING and FADING in the

ATLAS TWIN ARC WEATHER-OMETER



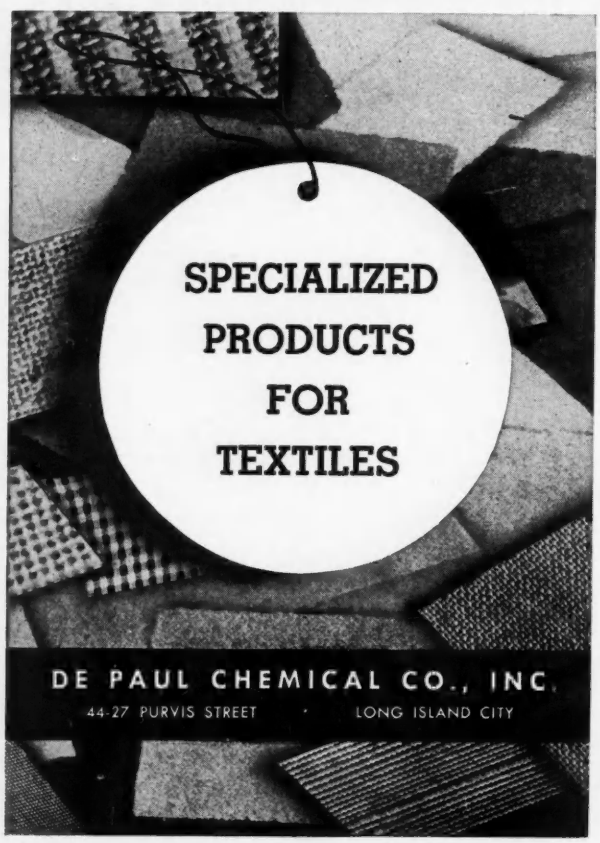
Faithfully duplicates the combined weathering effects of sunlight, rain, and heavy dew; accelerated to reduce years of actual weathering to a few days' testing. All weather cycles automatically controlled for continuous operation without attention.



ATLAS FADE-OMETER

The recognized standard testing machine in the textile field for determining the fastness to light of dyestuffs and fabrics. Fully automatic in operation.

ATLAS ELECTRIC DEVICES CO.
361 W. Superior St., Chicago 10, Ill.
Weather-Ometer • Launder-Ometer • Fade-Ometer

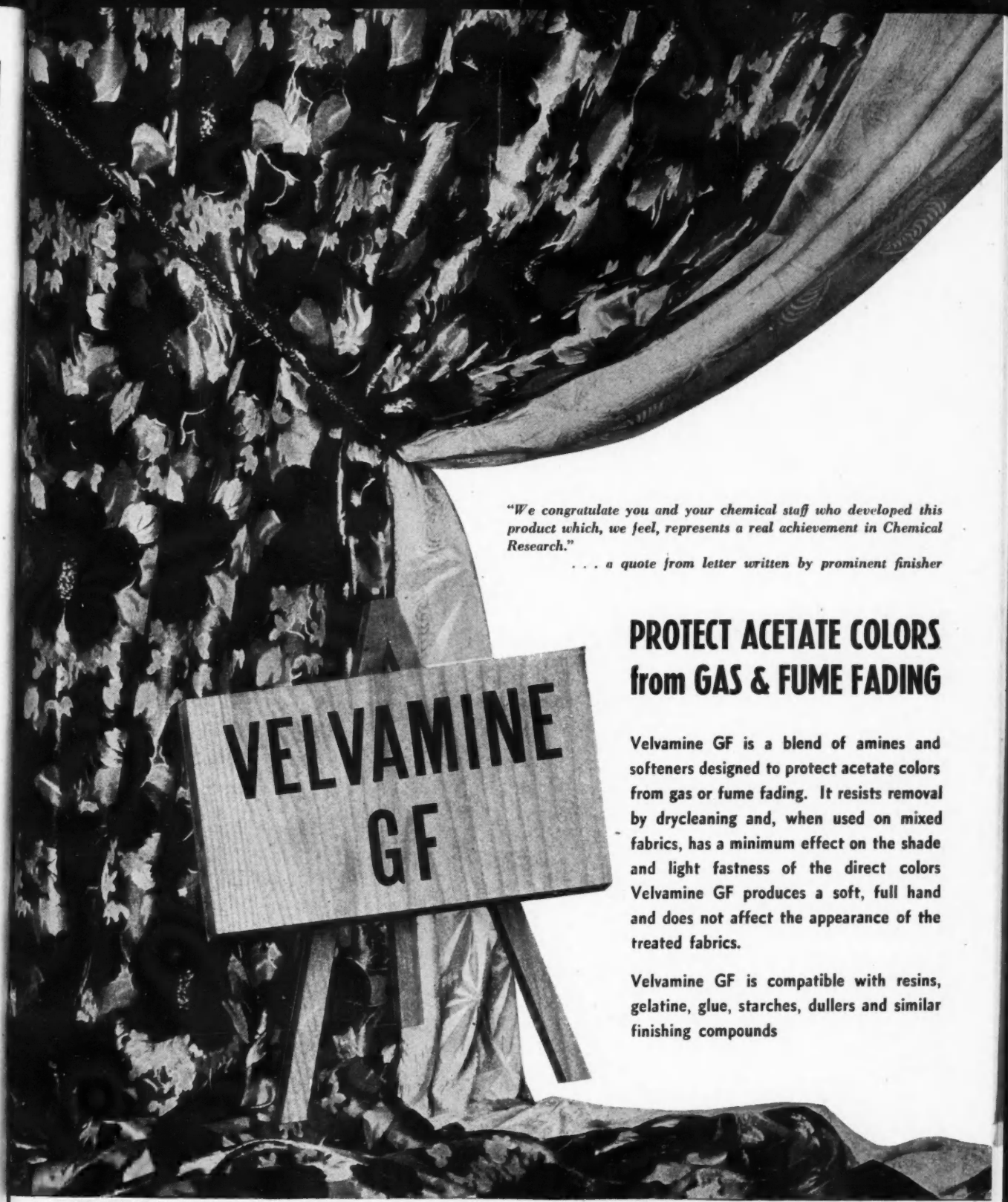


Have you ordered a Binder for your Reporter copies?

Maroon leatherette, gold lettered, large enough to hold twenty-six issues, only $2.50 post-paid.

Please send check with order to:

AMERICAN DYESTUFF REPORTER
ONE MADISON AVENUE
New York 10, N. Y.



"We congratulate you and your chemical staff who developed this product which, we feel, represents a real achievement in Chemical Research."

. . . a quote from letter written by prominent finisher

PROTECT ACETATE COLORS from GAS & FUME FADING

Velvamine GF is a blend of amines and softeners designed to protect acetate colors from gas or fume fading. It resists removal by drycleaning and, when used on mixed fabrics, has a minimum effect on the shade and light fastness of the direct colors Velvamine GF produces a soft, full hand and does not affect the appearance of the treated fabrics.

Velvamine GF is compatible with resins, gelatine, glue, starches, dullers and similar finishing compounds

REFINED PRODUCTS CORPORATION
Lyndhurst • New Jersey

* Manufacturers of PERMA-CIDE, the approved, outstanding, mildew-proofing agent

Southern Representative: DYER S. MOSS, 1301 Liberty Life Bldg., Charlotte, North Carolina

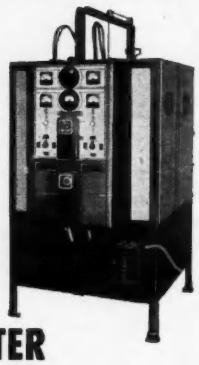
New England Representatives: E. L. LEGG, P. O. Box 597, Providence, R. I.
CLARENCE E. MOSS, 19 Wilson Ave., Rumford (16) R. I.

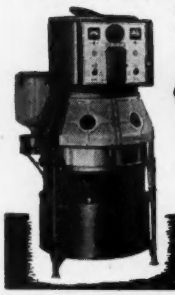
Canadian Selling Agents: Berkeley Products Canada, Ltd., 41 Hillcrest Avenue, St. Catharine, Ontario, Canada
Exporting Agent: Chem-Col Company, 82 Wall St., New York City

TEST TEXTILES for WEATHERING and FADING in the

ATLAS TWIN ARC WEATHER-OMETER

Faithfully duplicates the combined weathering effects of sunlight, rain, and heavy dew; accelerated to reduce years of actual weathering to a few days' testing. All weather cycles automatically controlled for continuous operation without attention.

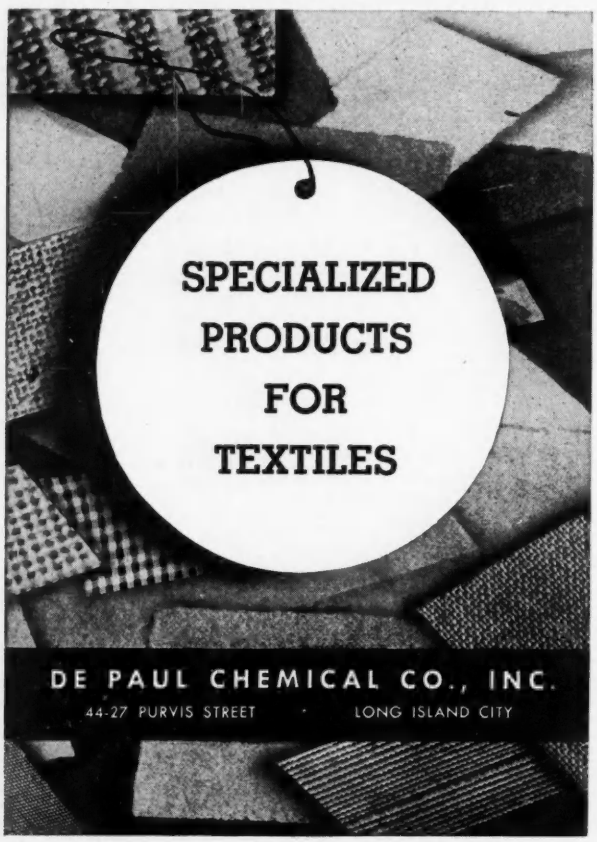




ATLAS FADE-OMETER

The recognized standard testing machine in the textile field for determining the fastness to light of dyestuffs and fabrics. Fully automatic in operation.

ATLAS ELECTRIC DEVICES CO.
361 W. Superior St., Chicago 10, Ill.
Weather-Ometer • Launder-Ometer • Fade-Ometer

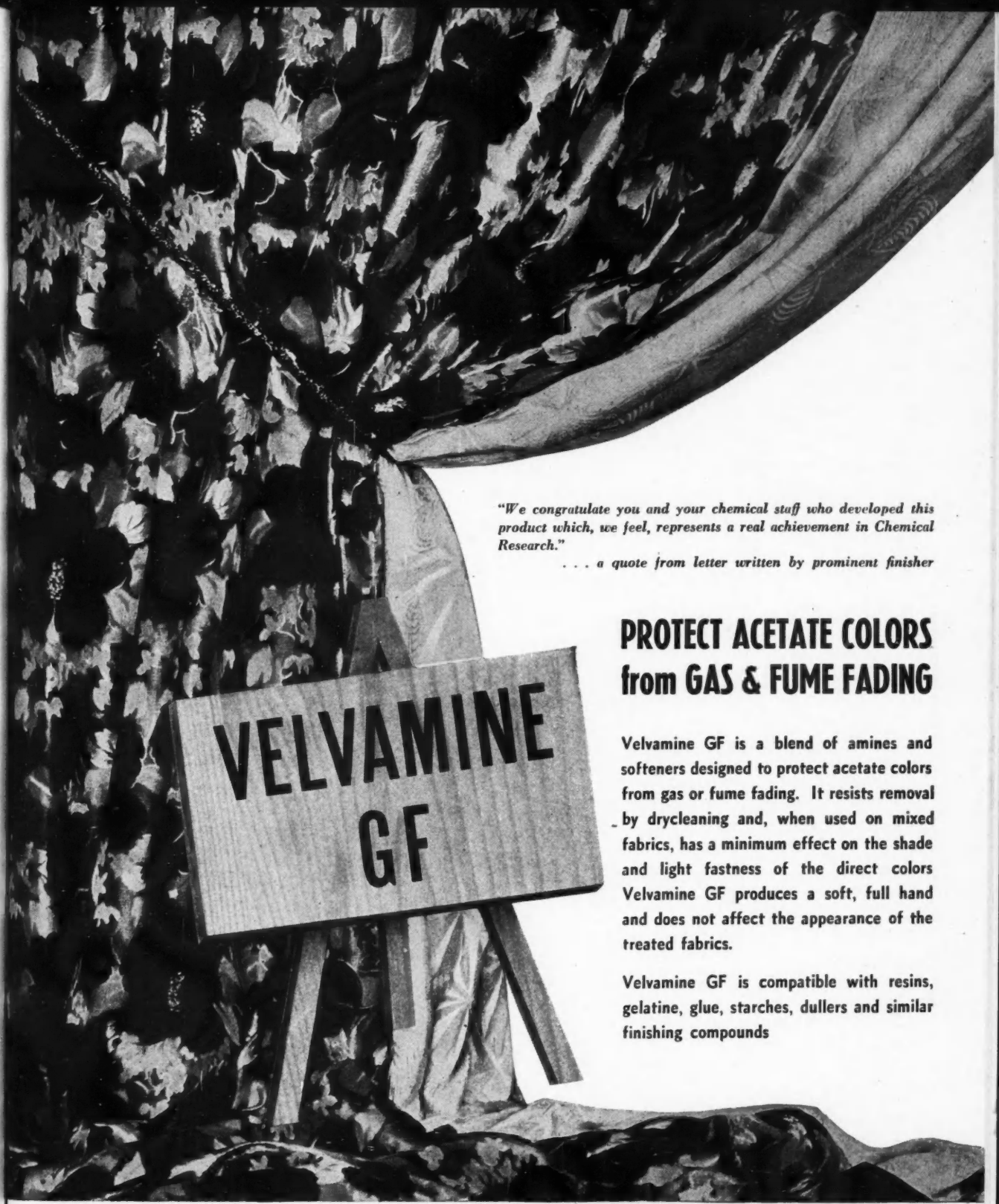


Have you ordered a Binder for your Reporter copies?

Maroon leatherette, gold lettered, large enough to hold twenty-six issues, only $2.50 post-paid.

Please send check with order to:

AMERICAN DYESTUFF REPORTER
ONE MADISON AVENUE
New York 10, N. Y.



"We congratulate you and your chemical staff who developed this product which, we feel, represents a real achievement in Chemical Research."

. . . a quote from letter written by prominent finisher

PROTECT ACETATE COLORS from GAS & FUME FADING

Velvamine GF is a blend of amines and softeners designed to protect acetate colors from gas or fume fading. It resists removal by drycleaning and, when used on mixed fabrics, has a minimum effect on the shade and light fastness of the direct colors Velvamine GF produces a soft, full hand and does not affect the appearance of the treated fabrics.

Velvamine GF is compatible with resins, gelatine, glue, starches, dullers and similar finishing compounds

REFINED PRODUCTS CORPORATION
Lyndhurst • New Jersey

* Manufacturers of PERMA-CIDE, the approved, outstanding, mildew-proofing agent

Southern Representative: DYER S. MOSS, 1301 Liberty Life Bldg., Charlotte, North Carolina

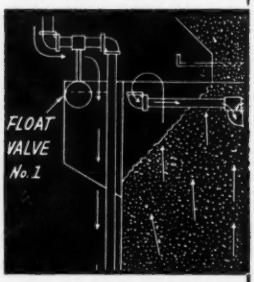
New England Representatives: E. L. LEGG, P. O. Box 597, Providence, R. I.
CLARENCE E. MOSS, 19 Wilson Ave., Rumford (16) R. I.

Canadian Selling Agents: Berkeley Products Canada, Ltd., 41 Hillcrest Avenue, St. Catharine, Ontario, Canada
Exporting Agent: Chem-Col Company, 82 Wall St., New York City

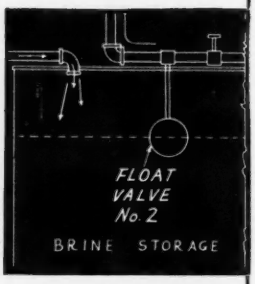
MYLES Brine Equipment Dissolves then Filters!

Once you have used brine that is double filtered, the Myles way, you'll never tolerate cloudy, impure brine again. The crystal-clear brine you get from Myles' exclusive "Double Filtration" gives you brighter, more level dyeings every time — and often costs less than brine from other equipment. You'll find many other attractive features in the Myles Double Filtration Brine Equipment, too:

- Myles original and patented DUAL CONTROLS regulate water intake and brine supply — insuring a thoroughly saturated brine.
- Myles is COMPLETELY AUTOMATIC.
- Myles equipment is non-corrosive made of Stainless Steel, Nickel or Monel with all Brass or Bronze fixtures.
- Uses Myles Rock Salt — eliminating caking, bridging, and channeling which occurs with moisture-absorbing salt.
- HAS FREE-FLOWING GRAVITY FEED.
- EASY TO CLEAN — assuring continuous efficiency.
- SIZES TO FIT EVERY NEED.
- The Myles Double Filtration Brine Percolators — widely used for years with outstanding results and economy.



1 SELF FILTRATION. *Controlled supply of water flows upward through rock salt, dissolving some of it. The solution then flows through the remaining rock salt before it reaches the top.*



2 SECOND FILTRATION. *The insoluable Calcium sulphate rapidly precipitates in the brine. After settling into the settling chamber, the brine passes upward through a gravel filter which removes the last traces of insoluable matter.*

Whatever your problem, Myles' trained technical men will help you before and after installation. There is no charge for this service.

Write today for complete illustrated booklet containing helpful brine charts.

MYLES SALT CO., LTD.

NEW ORLEANS, LA. CHARLOTTE, N. C.

QUALITY RICHMOND PRODUCTS

CUT DOWN DYEHOUSE *Headaches*
USE
DYETEX

- Disperses Dyestuff
- Scours
- Used in Scrooping

DYETEX

Send for free sample and full information

RICHMOND OIL, SOAP & CHEMICAL CO., Inc.
1041-43 FRANKFORD AVE., PHILADELPHIA 25, PA.

Laurel Brand means better, more efficient, lower cost finishing for your...

cotton wool silk rayon nylon

For over thirty-seven years Laurel has met successfully myriad challenges of leading dyers, bleachers and finishers with better, more efficient processing agents. Ask Laurel Technicians for their recommendations.

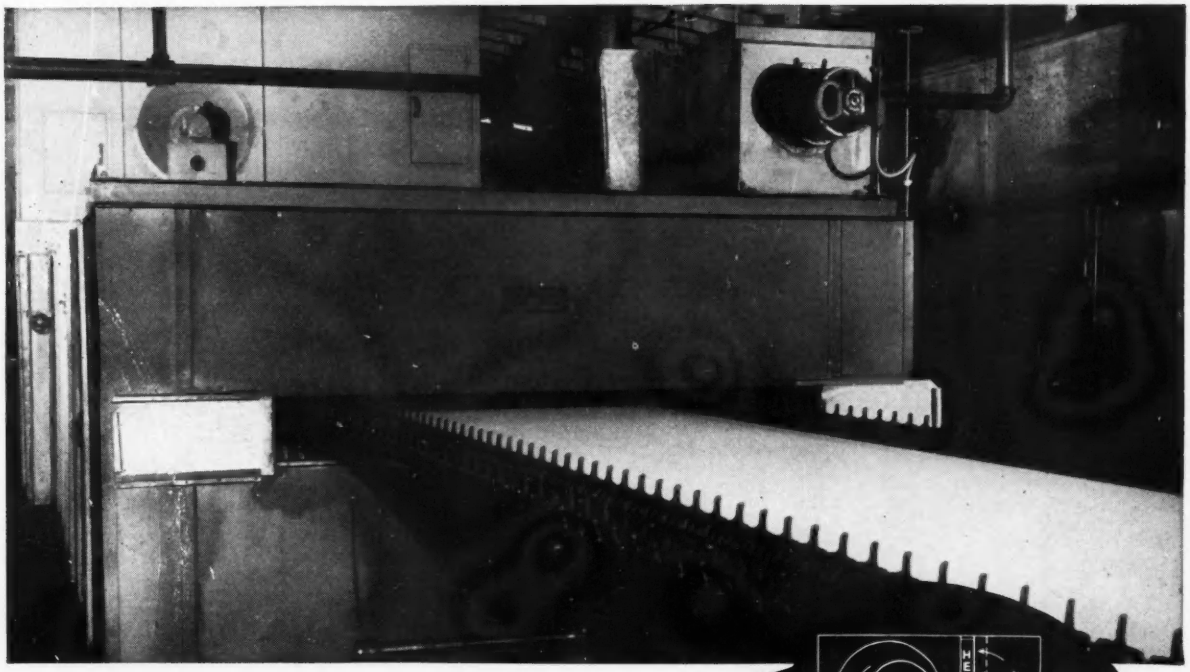
Laurel Boil-Off Oils and Compounds · Laurel Emulsions and Softeners · Laurel Hosiery Finishes · Laurel Nylon Finishes · Laurel Rayon Oils · Laurel Textile Oil · Laurel Wool Oils · Laurel Special Finishes

soaps, oils, finishes

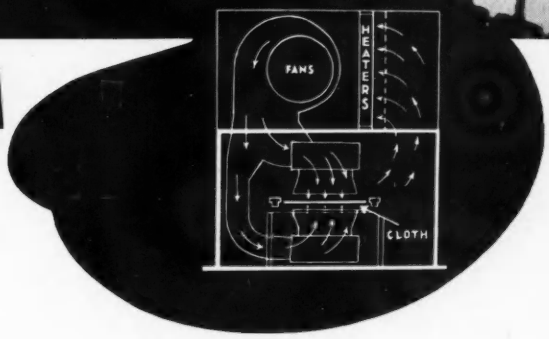
LAUREL SOAP MANUFACTURING CO., Inc.
Wm. H. Bertolet's Sons ESTABLISHED 1909
OFFICES— 2601 E. Tioga St., Philadelphia 34, Pa.
Warehouses—Paterson, N. J. • Chattanooga, Tenn. • Charlotte, N. C.

Unique air circulation makes possible

HIGH SPEED DRYING



PROCTOR *Super-Speed* SYSTEM APPLIED TO SINGLE RUN TENTERS



The factor which contributes most to the high speed operation that is possible with this modern system of tentering is *air circulation.* When a single run tenter is enclosed in a Proctor housing, air at high temperatures is impinged through nozzles against *both* sides of the fabric as it is carried through the drying chambers. Circulating through the goods, this penetration of uniformly heated air reduces drying time and increases output. The proper regulation of moisture in the air, so as to obtain speedy drying without harsh effects on the cloth, has an important bearing on the quality of the finished goods. Of course, output varies with individual plant requirements, length of the machine and the character and weight of the goods—but is always kept to a maximum by this system. Temperatures, air velocity and drying speed may be altered to suit a wide variety of fabrics and finishes. One of the most recent applications for this system has been in the drying of fabrics preparatory to curing. If the finishing of fabrics which must be held to width is part of your plant operation—investigate the decided advantages of the Proctor "Super-Speed" System applied to single run tenters.

PROCTOR & SCHWARTZ INC. *P & S* PHILADELPHIA 20, PA.

WP

Our top hats are off to the Silver Jubilee Convention issue of the Dyestuff Reporter. I read it from cover to cover, all advertising included. In this connection, Myron Reeser and associates did a bang-up job. Perhaps the best color display was that of the Ciba Company, while the Althouse Chemical Company carried an interesting history. The article by Charles A. Mace on the history of the Synthetic Organic Chemical Manufacturers Association, together with the picture of Charles H. Herty, Francis P. Garvin, and Morris Poucher brought back many pleasant memories. Francis P. Garvin was, in my estimation, the best after-dinner speaker I have ever heard, while the late Morris Poucher was a good politician who could handle hard-boiled Senators in the fight for survival of the dyestuff industry. I wonder if the next 25 years will produce such interesting men. I believe it will and with it, the result of research effort, particularly in the textile chemical field. Where does any industry offer as much to the chemist of vision? Just a word about the Convention itself: the Textile Luncheon—a new innovation—was a decided success. George Lindberg was a brilliant toastmaster. The speech of Kenneth Fox was outstanding and most interesting, while the conversation of "Bob" Sleeper at my table furnished the best fellowship. The entire convention, in fact, was handled in an efficient and business-like manner—an event long to be remembered. So hang on to that copy of the Silver Jubilee Convention number and compare it with the Golden Jubilee issue of 1971. Maybe I am an optimist and will attend the Convention with a cane. Who knows?

WATSON PARK CO

Boston — Mass.

Everything you've ever wanted in a Dye Box

THE NEW BLICKMAN *Fully Enclosed* STAINLESS STEEL DYE BOX

1. Greater savings in steam and water
2. Faster loading and unloading
3. Complete visibility
4. Quick changeovers

Send for further information

S. BLICKMAN, INC.

102 GREGORY AVENUE • WEEHAWKEN, N. J.

Manufacturers of stainless steel textile equipment, dye boxes, linings, cylinders, dry cans, rolls, hoods, tanks

WET PROCESSING AGENTS

BURK-SCHIER

FOR EVERY TEXTILE APPLICATION

PENETRANTS
DETERGENTS
SOFTENERS
REPELLENTS
FINISHES

BURK SCHIER

Burk-Schier Wet Processing Agents are made under careful plant and laboratory control. Technical service men always available.

BURKART-SCHIER CHEMICAL CO.
CHATTANOOGA, TENNESSEE

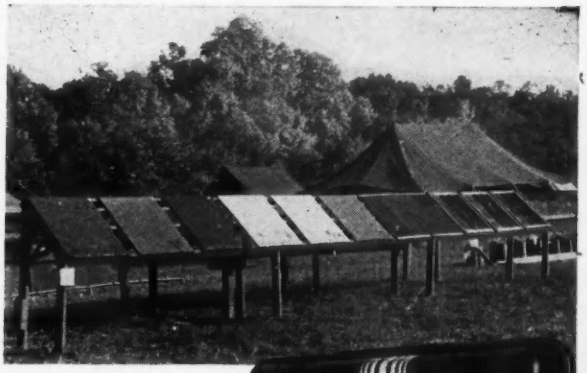
MANUFACTURING CHEMISTS FOR THE TEXTILE INDUSTRY

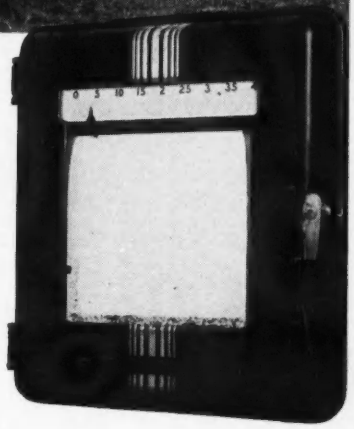
SYNTHETIC DETERGENTS

ANILINE COLORS
NATURAL DYESTUFFS
SIZINGS and FINISHING MATERIALS

UNITED
CHEMICAL PRODUCTS
CORPORATION

Main Office:
753 MONTGOMERY STREET • JERSEY CITY 6, N. J.
Plant:
YORK AND GOLGATE STREETS •• JERSEY CITY 2, N. J.
Branches:
GREENSBORO, N. C. • PAWTUCKET, R. I.
Western Agents: CHEMICAL PRODUCTS CO., AURORA, ILL.





The problem of weather damage to Army tents is being studied in this area at Camp Lee, Va. Here, among rows of tents, are the open racks of fabrics and thread and the instrument towers which the Smithsonian Institution and Army use in their research. Picture at right shows a Micromax Recorder used in this research.

Micromax Saves Observer's Time By Recording Solar Radiation

Smithsonian Institution scientists working at Camp Lee are saving an appreciable number of man-hours per week by using Micromax Recorders to collect data on solar and sky radiation. One of these instruments is connected to an Eppley Pyrheliometer and gives a clear, accurate, wide-chart record of the total solar radiation which falls onto the Eppley instrument in the tent-fabric research area, shown above. This Micromax is calibrated in gram calories per minute per centimeter square.

Another Micromax Recorder, not shown here, is a 16-point instrument recording temperatures of textile fabrics beneath various glass filters. It thus shows the temperature effect of screening out various wave-lengths of radiation.

These two Recorders eliminate the need for measuring and plotting radiation by hand several hundred times a day. In fact, the time required for a dozen of these measurements and plottings is probably ample to care for the Recorders for a week or more.

STANDARD INSTRUMENTS

These Micromax Recorders are entirely standard, sturdy, dependable instruments of the identical kind widely used for recording industrial temperatures and many other conditions measurable by null-electrical means. We will be glad to send further information on request.

LEEDS & NORTHRUP COMPANY, 4965 STENTON AVE., PHILA., PA.
LEEDS & NORTHRUP
MEASURING INSTRUMENTS • TELEMETERS • AUTOMATIC CONTROLS • HEAT-TREATING FURNACES
Jrl. Ad N-71(1a)

• CLASSIFIED ADVERTISEMENTS •

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $7.50 per column inch or less per insertion.

CONFIDENTIAL EMPLOYMENT SERVICE—For Dyers, Chemists, Colorists, Managers, Superintendents and others seeking positions and for employers seeking men. Charles P. Raymond Service, Inc., 294 Washington St., Boston, Mass. Over 45 years in business.

FOR SALE

Three (3) Smith, Drum Individual Stainless Steel Package Extractors.
Eight (8) baskets per unit.
Good Operating Condition.

Anchor Thread Company, Groveville, New Jersey

Phone Trenton 5169

WANTED: SALESMAN - TECHNICIAN, man with broad experience in both selling and technical "trouble shooting" to call on textile mills, also on paper industry, as representative of highly regarded, old established chemical firm. State full details. Write Box 163.

WANTED: SALES REPRESENTATIVES: Manufacturer of complete line of chemical specialties offers good opportunity for experienced salesmen. Territories open—New England, Pennsylvania, Metropolitan New York and the Carolinas. Give complete information—include age, selling experience, education, etc. Write Box 167.

DYESTUFFS WANTED, ALL TYPES, LARGE AND SMALL QUANTITIES, EXCESS INVENTORIES, ALSO INTERMEDIATES AND CHEMICALS. Write Box 171.

Organization furnishing 20 years colors and chemical products to the Italian Textile Industry, seeks agency. Also interested to manufacture in Italy against license. The proprietor will soon be in U. S. A. to deal. Write Franco Rol—G. Govone nr. 10—Torino, Italy.

POSITION WANTED: Dyer, 15 years experience skein and package dyeing; 7 years experience in piece goods dyeing. Write Box 175.

POSITION WANTED: Textile Chemist, degree in Chemistry. Experience includes 4 years Viscose Rayon production, 5 years general textile laboratory research and control work on all types of fibers and yarns and materials related to them. Interested in technical sales or production as well as laboratory work. Eastern states or New England areas preferred. Age 35 years. Write Box 173.

POSITION WANTED: Colorist or Superintendent of printing in roller printing plant. Ten years experience as colorist and six years as superintendent of printing. Experienced on cotton and rayon and all present types of dyestuffs. Southern plant preferred. Write Box 174.

WANTED: Dyes, spot or immediate shipment, preferably Congo, Metanil Yellow, Basie Magenta, Methyl Violet, Direct Green, Turquoise Blue G, Indigosol O4B, Indanthren Browns-Violets-Blues-Greens. Quote lowest prices and maximum quantity available. Write Box 176.

Chief Chemist wanted for large tricot underwear plant in South. Must be capable of directing control laboratory and supervising the dyeing and finishing of acetate, nylon, and viscose fabrics. Address in confidence Charles P. Raymond Service, Inc., 294 Washington Street, Boston, Mass. Over 45 years employment service for textile mills.

TEXTILE CHEMIST: Leading chemical manufacturing firm, located Metropolitan area, requires services competent, practical chemist experienced in the throwing and hosiery field for development and technical field work with sales staff. Please state fully experience, salary arrangements and availability. Write Box 177.

PRACTICAL DYER-FINISHER. Well established manufacturers of textile processing chemicals launching international expansion program seek highly experienced dyer-finisher for advisory, technical service and developmental work and to assist sales staff. Give full history and salary expected in first letter. All correspondence held confidential. Write Box 178.

FOR SALE. Aridex WP and ST totalling about 11,000 lbs. Write Marathon Rubber Prod. Co., Wausau, Wisconsin.

WANTED: Experienced Cotton Piece Goods Dyer on Sulfurs and Vats, both Jibs and Continuous. Knowledge or experience with kier and open width scouring and bleaching, also mercerizing. Good opportunity-progressive mill with Finishing Plant. Location: Southeast. Write Box 179.

Two great CHEMICALS for COTTON

VIRGINIA
SODIUM HYDROSULFITE
$Na_2S_2O_4$

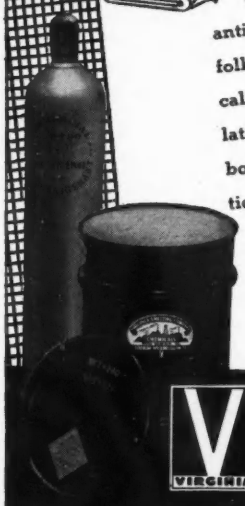
VIRGINIA Hydrosulfite is a concentrated, white, stable, free-flowing uniformly crystalline powder, readily soluble in water. 100 lbs. of water at 68° F. will dissolve 21.8 lbs. $Na_2S_2O_4$. Easy and complete solubility, and carefully controlled particle size recommend VIRGINIA "Hydro" as a preferred reducing agent for vat dyeing and stripping. Shipped in air-tight steel drums, 250 lbs. net weight.

Shipment will be made from West Norfolk, Va., in Carload and Less Carload lots; L. C. L. shipments from stocks in Boston Chicago, New York, Philadelphia, Charlotte and Atlanta.

"ESOTOO"
Liquid SO_2

VIRGINIA "ESOTOO" is an ideal antichlor. Its popular adoption has followed the development of a practical semi-automatic method for regulating SO_2 concentrations in the sour box. Write for a complete description of the VIRGINIA method.

VIRGINIA "ESOTOO" is shipped in steel cylinders 150 lbs. net weight.



VIRGINIA
SMELTING COMPANY
WEST NORFOLK, VIRGINIA
New York • Philadelphia • Boston
Charlotte • Detroit

DEXTER

• *Is unlevel dyeing a problem to you?*

Consult Dexter
INDUSTRY'S RIGHT HAND

Dexter Chemical Corporation
TEXTILE CHEMICAL DIVISION
819 EDGEWATER ROAD, NEW YORK 59, N. Y.

IDAHO
Potato Starch
"THE FINEST MADE"

MAGIC VALLEY PROCESSING COMPANY
OF IDAHO
•
ST. ANTHONY STARCH COMPANY, INC.
OF IDAHO
•
MENAN STARCH COMPANY, INC.
OF IDAHO

DISTRIBUTED BY
AMERICAN KEY PRODUCTS, INC.
15 PARK ROW • NEW YORK 7, N. Y.

10 PRODUCTS of Proven Dependability

WHICH SHOULD WARRANT ★ YOUR ATTENTION ★

***AQUAROL :** A water repellent for processing woolen, cotton and rayon fabrics, also produces excellent results in splashproofing or finishing all types of hosiery.

***PARAMINE S :** A cation active softener for processing cotton and rayon cloth to obtain a soft, smooth, pleasing finish.

***ALGEPON S :** An assistant in dyeing vat colors to prevent premature oxidation of the reduced bath and eliminate uneven dyeings.

***ALGEPON V A :** Assistant for stripping vat colors—complete reduction of color in stripping bath providing lighter bottom for redyeing.

***PARAPON S A :** A highly efficient leveler and softener for dyeing and finishing all types of yarn, cloth and hosiery to produce a uniform dyeing and a soft full hand.

***ARIPEL F S :** Finish and gas inhibitor for processing dyed acetate rayon—produces a soft full feeling finish and prevents gas fading of the color.

***LANITOL F :** A synthetic detergent possessing exceptional scouring and washing properties for processing wool, cotton, rayon or nylon.

***CULOFIX :** Used as an after treatment in last rinse to prevent bleeding of direct dyed cotton or rayon in water.

***DIAZONOL A C :** For boiling out cotton cloth in pressure or open kiers to produce greater absorbency and cleaner material. Excellent for preboiling knitted cloth in preparation for chlorine bleach. Also used with good results for boiling out cotton or rayon cloth on the jig.

***TETRANOL 1638 :** A rapid wetting and penetrating agent. Active in acid, alkaline and salt solutions and not affected by hard water, may be used in all types of dyeing operations to insure positive penetration of color and a uniform and solid shade.

And a Complete Line of Oils, Chemicals, Softeners and Finishes For Wet Processing All Textile Fibres

*Reg. U.S. Pat. Off.

ARKANSAS CO. Inc.

Newark, New Jersey

ESTABLISHED OVER 40 YEARS

INDEX TO ADVERTISERS

Althouse Chemical Co.
Amalgamated Chemical Corp.
American Aniline Products, Inc. XVII
American Cyanamid Co. (Ind. Chem. Div.) ..... Second Cover
American Cyanamid Co. (Textile Res'n Dept.)
American Dyewood Company
American Key Products, Inc. XXXVII
Arkansas Company, Inc. XXXVIII
Arnold, Hoffman & Co., Inc. VII
Atlantic Chemical Co.
Atlas Electric Devices Co. XXX

Becco Sales Corp.
Bick & Co., Inc.
Bickman Co., S. XXXIV
Burkart-Schier Chemical Co. XXXV
Butterworth Sons Co., H. W.

Calco Chemical Division American Cyanamid Co.
Calgon, Inc. XVI
Campbell & Co., Inc., John.
Carbic Color & Chemical Co., Inc. XXIV
Carbide & Carbon Chemicals Corp. VIII
Ciba Company, Inc. III
Colgate-Palmolive-Peet Co. X
Commonwealth Color & Chemical Co.

De Paul Chemical Co., Inc. XXX
Dexter Chemical Corp. XXXVII
DuPont de Nemours & Co., E. I.
Dyestuff Division

Electro Metallurgical Co.
Emery Industries, Inc.

Fallek Products Co., Inc. XII
Fancourt & Co., W. F.

Geigy Company, Inc. ..... Front Cover
General Dyestuff Corp. V
Girdler Corp., The VI
Givaudan-Delawanna, Inc.

Hardesty Co., W. C.
Hart Products Corp.
Heyden Chemical Corp. ..... Third Cover
Hooker Electrochemical Co. XVIII

Interchemical Corp., Textile Colors Div.
International Salt Co., Inc.

Kali Manufacturing Co.
Kelco Co.

Laurel Soap Mfg. Co., Inc. XXXII
Leatex Chemical Co.
Leeds & Northrup Co. XXXV
Linotone Corp. XXVIII

Maher Color & Chemical Co. XXXIX
Mathieson Alkali Works, Inc. IX
Maywood Chemical Works XIV
Monsanto Chemical Co. XIII
Myles Salt Co., Ltd. XXXII

National Aniline Division, Allied Chemical & Dye Corp. XI
National Carbon Co. XIX
National Oil Products Co. XXII
National Starch Products Inc.
Nova Chem. Corp. XXVIII
Nyanza Color & Chemical Co.

Onyx Oil & Chemical Co. IV

Pabst Sales Company.
Perkins & Sons, Inc., B. F. XX
Philadelphia Quartz Co. XL
Procter & Gamble. XXXIII
Proctor & Schwartz, Inc.

Refined Products Corp. XXXI
Richmond Oil, Soap & Chemical Co., Inc. ..... XXVIII, XXXII
Rohm & Haas Co.
Royce Chemical Co. ..... Back Cover
Rumford Chemical Works.

Sandoz Chemical Works. XXVII
Scholler Bros., Inc.
Socony-Vacuum Oil Co., Inc.
Solvay Sales Corp.
Sonneborn Sons, Inc., L.
Standard Brands, Inc. XXIX
Standard Chemical Products, Inc.
Standard Oil Co. of N. J. XXI
Stein Hall & Co., Inc.

Tennessee Eastman Corp. XV
Titan Chemical Products, Inc.

Ultra Chemical Works, Inc. XXIII
Union Carbide & Carbon Corp. ..... VIII, XIX
United Chemical Prod. Corp. XXXV

Van Vlaanderen Machine Co.
Virginia Smelting Co. XXXVII

Wallerstein Co., Inc. XXVI
Warwick Chemical Co.
Watson-Park Company XXXIV
Wolf & Co., Jacques.

Young Aniline Works.
Young Co., J. S.

Zinsser & Co., Inc.

Shortage of BON?

don't worry...

Hydroxanil

TAKES ITS PLACE!

TRUE wash fast DEVELOPED BLACKS giving uniform results from batch to batch are assured with HYDROXANIL and Maracel Developed Black A. Blacks produced with HYDROXANIL require no shading with orange or yellow as customary with BON thereby eliminating yellow stains on white trimmings.

SAVES TIME and TROUBLE

HYDROXANIL is simple to use—requires no caustic soda. Simply stir into boiling water and add to developing bath. Developing may be carried out in the diazotizing solution if desired to save additional rinsing operations and running time. (Simple instructions sent upon request). HYDROXANIL may be added at any pH range from 4½ to 7 and will operate at any temperature from 100° to 140°F.

...Develops Complete in 30 Minutes!

No excess rinsing or soaping required! Two batches dyed in the time usually required for one.

MARCO PRODUCTS

MAHER COLOR & CHEMICAL CO.

FACTORIES AND LABORATORIES

355 West Ontario Street, Chicago 10, Ill.

2327 East Eighth Street, Los Angeles 21, Calif.

THIS TEAM PULLS *Smoothly* IN HOSIERY SCOURING

Whether your choice falls on soap or synthetic detergents for scouring and dyeing rayon or nylon hosiery, you can count on topnotch results with either Olate or Orvus. A glance at some of the characteristics of these two time-tested cleansing agents will guide you in your choice.

Olate

A pure, neutral soap of exceptionally low titer.

Fast dissolving—free rinsing.

Fluid solutions wet out fibers quickly, evenly, thoroughly—guard against uneven dyeing.

Excellent emulsifying properties. Holds spinning and coning oils firmly in suspension until they are flushed.

Resists oxidation, rancidity and odor development.

ORVUS*

Provides thorough, uniform penetration of dyestuffs.

Thoroughly emulsifies and removes coning and knitting oils.

Prevents lime soap specks and oil spots.

Minimizes danger of non-uniform dyeing on cotton tops and feet.

Eliminates streakiness and blotches.

Procter & Gamble

*TALK OVER YOUR ORVUS NEEDS WITH YOUR PROCTER & GAMBLE SALESMAN.

Formaldehyde-Heyden

FORMALDEHYDE-HEYDEN performs many important tasks in the Textile Industry. One is crease-proofing and crush-proofing of cellulose fabrics and fibers. This is done either by treating the fabric directly with Formaldehyde or with water solutions of special synthetic resins, made with Formaldehyde.

These resins are used also in combination with alkyds to coat or change the "hand" of textiles as, for instance, in the glazing of chintz.

Formaldehyde is further used as a preservative in sizing compounds to prevent mildew forming on the dried sized warp and finished woven goods.

FORMALDEHYDE-HEYDEN has set the standard of dependability for more than forty years. You can rely upon it for uniformity.

Further information and Technical Data Sheets will be sent upon request.

HEYDEN

FINE HEYDEN CHEMICALS

Chemical Corporation

393 SEVENTH AVE. NEW YORK 1, N. Y.

Chicago Sales Office: 180 N. Wacker Drive, Chicago 6, Ill.

Benzaldehyde · Benzoates · Benzoic Acid · Benzyl Chloride
Bromides · Formates · Chlorinated Aromatics · Medicinal
Creosotes · Formaldehyde · Formic Acid · Glycerophosphates · Medicinal Guaiacols · Hexamethylenetetramine
Penicillin · M.D.A. · Paraformaldehyde · Parahydroxybenzoates · Pentaerythritols · Salicylates

DO NOT CIRCULATE

A TEXT for better TEXTILES

GREENVILLE PUBLIC LIBRARY

DO NOT CIRCULATE

DO NOT CIRCULATE

NEOZYME*
A concentrated, fast-working, powdered, desizing agent containing enzymes which will remove starches or proteins. For use in any conventional desizing machine.

PAROLITE*
A dust-free, white crystalline reducing agent. Soluble, colorless, excellent for stripping wool rags, shoddy, acetate or Nylon fabric.

VATROLITE*
For brighter vat dyed colors on cotton, linen and rayon. Use this powerful concentrated reducing agent for faster, cleaner results on wool and piece goods.

VELVORAY*
A blend of vegetable oils and specially selected fats for a superior, non-foaming, finishing oil. High in combined SO_3 and stability.

DISCOLITE*
A concentrated reducing agent, highly stable at high temperatures, outstanding for discharge printing. Employed successfully wherever the reducing agent must dry into the fabric and retain its reducing power.

FABRITEX*
An improved textile gum of laboratory-check viscosity for printing on all fabrics, especially silk, and synthetic fibres.

GUMOLITE*
A refined, no-stain gum, proved valuable in achieving purest possible white effects in discharge printing.

CASTROLITE*
A highly sulphonated castor oil used as a staple penetrant for dyeing or bleaching in leading textile mills.

In textile chemicals . . . for the effects you want, the buy-word is . . . "for the *right* choice, buy Royce". A Royce sales engineer will gladly give you full details on any Royce product on request.

2 NEW ROYCE CHEMICALS

DRYTEX*
A stable wax-emulsion type water repellent finish having extreme stability both in the barrel and in diluted form as used.

ZIPOLITE*
A superior wetting agent effective in acid and alkaline liquors at all temperatures from cold to boiling.

ROYCE CHEMICAL CO.

*Registered trade mark

ROYCE CHEMICAL CO.

CARLTON HILL, NEW JERSEY